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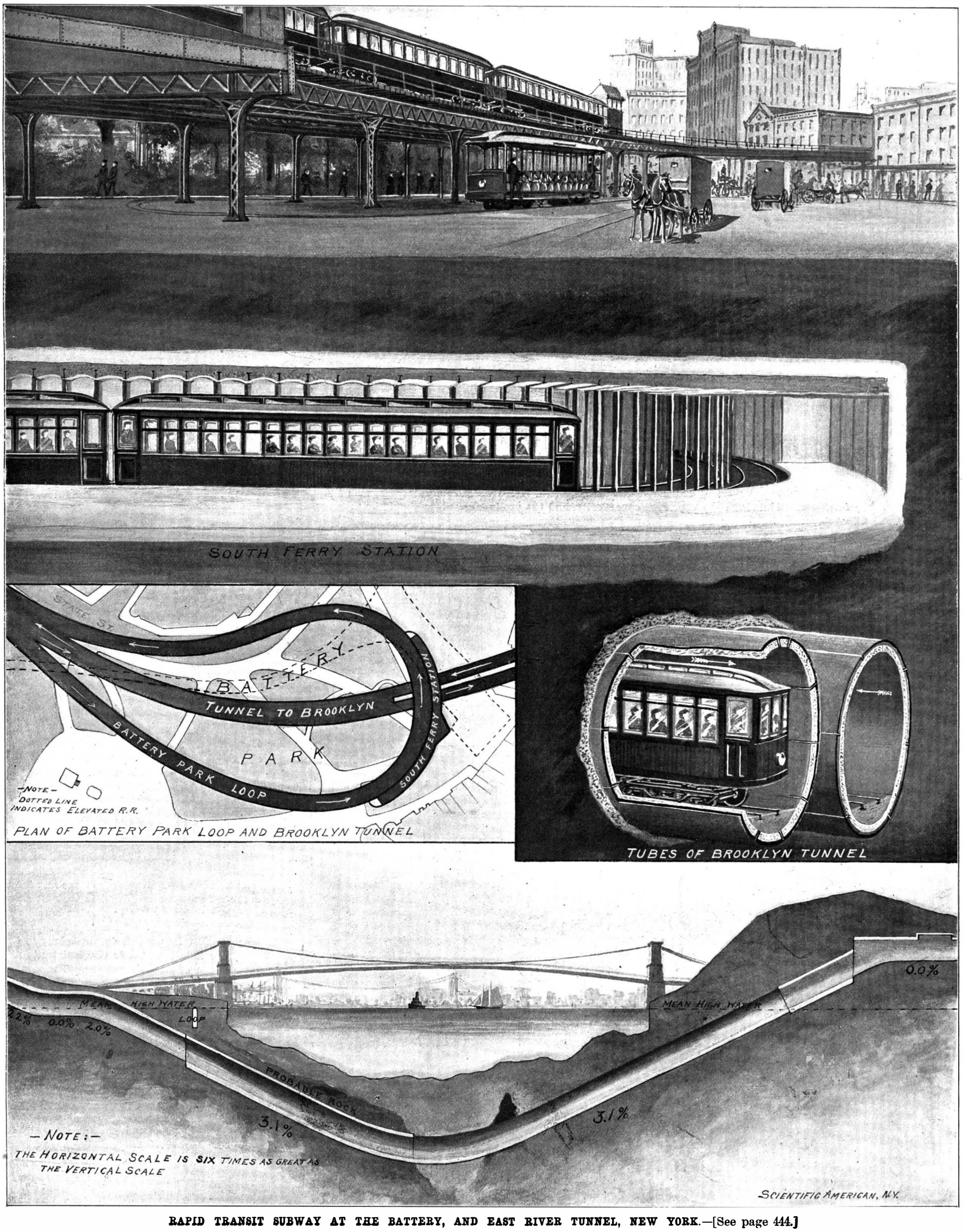

RAPID TRANSIT SUBWAY AT THE BATTERY, AND EAST RIVER TUNNEL, NEW YORK.—[See page 444.]

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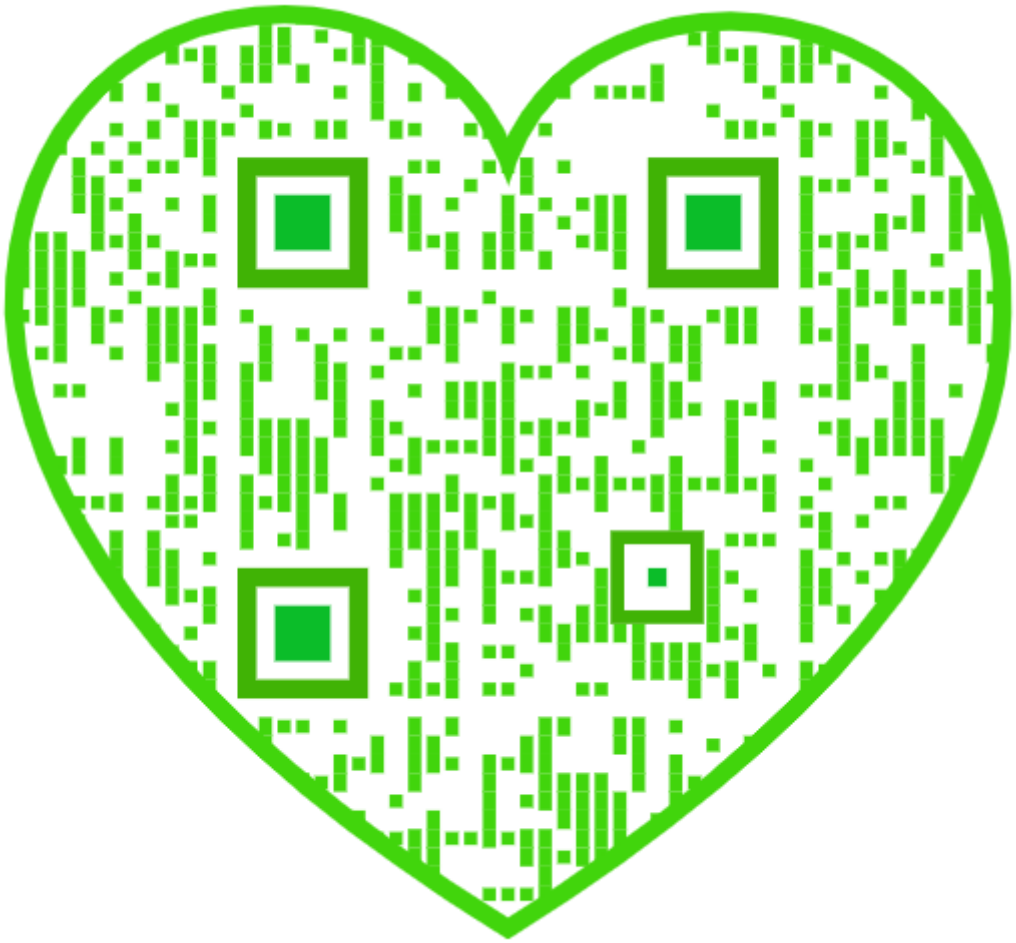

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NEW YORK, SATURDAY, DECEMBER 20, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TRANSPORTATION PROBLEM IN NEW YORK CITY.

The extraordinary congestion of its passenger traffic is the most serious problem confronting the city of New York, and particularly that portion of it that is embraced by Manhattan Island. We had all of us hoped that with the completion of the electrical equipment of the street surface and elevated lines, there would be a marked loosening of this congestion; but in this we have been disappointed. Not only has there been no improvement, but the congestion has appreciably increased; indeed, there has never been a time when the means of travel appeared to be more helpless to meet the demands imposed upon them. Go where you will, north or south, east or west, at street level or on the elevated system, there is to be found, during the rush hours, a congestion that baffles description, and can only be appreciated by those who are subjected to its miseries morning and evening. We are speaking now merely of Manhattan Island itself. The chaos on the Brooklyn Bridge is too well known to call for any description here.

The city is just now reaping the bitter fruits of the want of foresight, or supine indifference (to say nothing of the political corruption) of former municipal administration. As far as the Rapid Transit Subway is concerned, it would have been open four or five years ago had it not been for political influence coupled with the opposition of a few small-minded shopkeepers, who were afraid of a temporary loss of trade during the work of construction. As it is, fully another twelve months must elapse before the system is even partially in operation, and it is due to the splendid energy shown by the contractor that we shall not have to wait nearly two years before the line is declared open. If trains are running by the first of January, 1904, the city will be indebted to Mr. McDonald, the contractor, for having pushed the work to completion nine months before the date named in the contract.

The fact of the matter is, that travel on Manhattan Island has always increased at a much greater rate than was anticipated; and, as a consequence, the provisions, great as they were, made for handling the traffic by opening new lines and improving the rolling stock and methods of operation of existing lines, have always been years behind the necessities of the city.

What are we going to do about it? Judging from the talk of the man on the street, and the more serious discussions of the question in the columns of the daily press, we are looking forward to the opening of the Rapid Transit Subway for a complete solution of the difficulty, and are forgetting that the capacity of the new line, after all, will be but a limited quantity, while the growth of passenger travel is proceeding at an ever-increasing rate. If we are content to sit still, satisfied with our $35,000,000 effort, it will be but a comparatively short time before the Rapid Transit Subway, like the street surface lines and the electrified elevated lines, will be swamped by the volume of traffic that will roll in upon it. Very few of the citizens of Manhattan Island realize at what an astonishing rate our passenger traffic is growing. Ten years ago, the total number of passengers traveling north and south annually over the lines of the Metropolitan Street Railway Company on Manhattan Island was 175,000,000. In 1896 the total had increased to 255,000,000, and in 1902 to 465,000,000. Ten years ago the Manhattan Elevated Railway carried 216,000,000 passengers in the year. With the opening of, first, the cable railways, and then the electrical railways, by the Manhattan Street Railway Company, there was naturally a transfer of a large number of passengers from the elevated to the surface systems, so that, in 1896, the total elevated travel had fallen to 185,000,000. With the electric equipment of the elevated railroads, however, there was a return of travel to that system, so that, in 1902, the totals had risen to 215,000,000 passengers, or about what it was ten years before, when its only competitors were the miserable horse car surface lines, which have since been amalgamated to form the admirable properties of the Metropolitan Street Railway Company. The total north and south travel obtained by adding the figures for the Metropolitan to those of the Elevated system are, for 1892, 391,000,000; for 1896, 440,000,000; for 1899, 553,000,000; and for 1902, 627,000,000;—an increase in ten years' time of 62 per cent. In addition to the north and south travel, there are some stupendous totals of east and west travel, which takes place entirely on the Metropolitan Street Railway system. Thus, in 1892, there was a total east and west travel of 61,000,000 passengers; in 1896, there were 80,000,000 passengers east and west; and, in 1902, the total had risen to 121,000,000. Adding the total east and west and north and south travel, we find that the growth during the past decade has been as follows: In 1892, the total number of passengers was 452,000,000; in 1896, the total had risen to 520,000,000; in 1898, it was 605,000,000; in 1900, it was 716,000,000; in 1901, the total was 785,000,000; while last year, it had risen to the vast number of 801,000,000, an increase, during a single decade, of 77 per cent.

Now to meet this growing traffic, although several new lines have been constructed, the chief provision has come chiefly from the improvement of existing lines, the small and slow-moving horse cars being replaced by commodious and swiftly-running electric cars; while on the elevated there has been an increase, due to the new electrical equipment, of from 20 to 30 per cent in speed, and of 20 per cent in the capacity of the trains, the latter due to the introduction of six-car in place of five-car trains. Although these improvements and extensions provided a large increase in carrying capacity, it was nothing like so large as the 77 per cent increase in the number of passengers; and hence we predict that by the time the Rapid Transit Subway is in operation, the whole of its four tracks will be taxed to their utmost to relieve the present situation, leaving practically no margin for the future expansion of travel in this city.

Now the lesson that is clearly written upon these statistics is, that we ought at once to make provision, on a far more extensive scale than we have ever done in the past, for the future growth of travel in this city. And since the surface lines have appropriated practically all the streets, and because, on account of their inherent ugliness, the construction of additional elevated roads is out of the question, it is evident that any additional lines constructed in this city must be built underground. Here we have unlimited space and opportunity, and the preliminary steps should be taken at once toward constructing a tunnel on the east side above Forty-second Street, either under Madison or Lexington Avenue; moreover by the time work has been begun on this line, provision should be made for the construction of additional tunnel lines extending the whole length of the Island from the Battery to the Bronx, one to the west of the present Subway, and the other to the east of Third Avenue. Of course, we are fully aware that in providing the necessary funds for construction, there is the ever-recurring question of exceeding the city's debt limit, but this difficulty will be met, in part, by the natural increase in the assessed value of property, while the city could well afford to curtail its appropriations for improvements that are less urgently needed, in order to allow of a liberal apportionment for this, the city's greatest want.

A PROPOSED DUODECIMAL SYSTEM OF WEIGHTS AND MEASURES.

The American Society of Mechanical Engineers has apparently not yet given up the idea of combating the introduction of the metric system into the United States. As a kind of compromise between the existing system and the metric, Prof. S. A. Reeve recently proposed before the Society a duodecimal system, which takes as its standard the English yard. Upon the yard a system is to be reared, exactly as a system has been built up upon the meter. The divisions, however, are duodecimal to suit the duodecimal numbers. It is claimed that small units of length will be obtained which are exactly equal to those now in use in machine-shops. A unit of volume will be obtained corresponding with the meter, which unit is practically equal to the existing pint. This new pint, which is a cube measuring 3 inches on each edge, when filled with distilled water weighs within 2½ per cent of the present standard pound.

The standard yard multiplied by 1,000 (which is the duodecimal expression for 1,728 decimal) very closely equals the statute mile. Prof. Reeve believes that this new system of units is as beautifully correlated as are the measurements of the metric system.

So far as the influence of the proposed change on coinage is concerned, Prof. Reeve states that if the arithmetical notation and the standard of weights and measures unite in becoming purely duodecimal in character, the monetary system is bound to follow. The standard of value, the dollar, and all its unit representations would remain unchanged. All bills of five dollars or higher denominations would naturally be called in, and their equivalent issued in denominations of three, six, dozen, gross dollars, etc. This process could be as gradual as desired. Under duodecimal notation five and ten dollar bills would be inconvenient, but they would be usable. The half dollar and quarter dollar would remain unchanged. The dime, the nickel and the cent would have to be retired. In their place would be issued fractional currency under the following plan:

1 dollar = 10 bits (one dozen bits of 8 1-3 cents value each).

1 bit = 10 groats.

1 groat = 10 grets (for purposes where the mill is now used).

The probable coins would be:

Silver half-dollar (= 50 cents) = 6 bits = 60 groats.
Silver quarter (= 25 cents) = 3 bits = 30 groats.
Silver bit (= 8 1-3 cents) = 1 bit = 10 groats.
Nickel half-bit (= 4 1-6 cents) = 6 groats.
Copper quarter-bit piece (= 2½ cents) = 3 groats.
Copper groat (= 0.7083 cent).

Change for a quarter could ordinarily be had in a single convenient denomination, that is, in three silver bits, whereas now it requires two denominations, dimes and nickels, to make it. The practical objections to relying upon nickels alone for changing quarters are obvious. The progress of business toward finer margins and lower prices is steadily making the cent too large for many retail transactions. The smaller value of the groat meets this need.

The duodecimal system, as proposed by Prof. Reeve, necessitates the introduction of two new numbers. They are inserted by him between the 9 and the 10. The first is a peculiar-looking combination of the figure 1 and the 0, and is called the dek; the second is like an inverted 3, and is called an eln. Thus when our decimal 10 is reached it signifies a dozen. Prof. Reeve has compiled some interesting new names for his duodecimal numbers, such as "dozone" (thirteen) "fitze" (five dozen), "twodz-nine" (two dozen and nine), etc. This, of course, brings in the use of the dek and eln, and he has "dedz" (dek dozen), etc.

RETURN OF THE JESUP SIBERIAN EXPEDITION.

After a two years exploration of northern Siberia, a part of the Jesup North Pacific exploring expedition has returned to New York. The expedition was headed by Mr. Waldemar Jochelson, a Russian scientist of great repute. The expedition visited regions never before reached by a white man, and found races of people of whom the civilized world knows as yet nothing. Mr. Jochelson and his party collected 15,000 specimens. The collection will be installed in the American Museum of Natural History, and will probably excel that of any other museum in the world. In one of the New Siberian Islands in the Arctic Ocean the tusk of a mammoth was unearthed which is without doubt the largest yet found. It weighs 220 pounds. Other tusks and bones of mammoths were brought from the Anadyra River. About 2,000 bone carvings, executed in a manner that would do credit to an artist of civilization, were gathered. Eight complete sets of iron armor, similar to that made by the early Japanese, are also included in the collection.

Mr. Jochelson states that the tribes which he studied in Siberia all possessed characteristics in common with the Indians of North America. That these tribes were not found before was due to the fact that they inhabited a remote region, and that they have nearly been wiped out by disease and starvation. Some of the tribes had legends, language, and customs almost identical with those of the American Indians. One great tribe, the Yukoghirs, has been reduced by starvation and smallpox from many thousands to seven hundred persons. It occupies the Kolyma district, which contains 14,000 square miles. The tribe has no reindeer, but uses dogs to a limited extent. Having nothing to ride, they walk. Women drag the sledges in winter. In summer the men and women dwell in tents of skins and boughs. In winter they live in wooden huts. The Yukoghirs are the remnant of a Paleo-Asiatic race, and are one of the small tribes which do not belong to the main stock of the Asiatics. Their physical traits are different from those of the Mongolians. They are a small, slender people, well shaped, with small round faces. Some of the women have fair, almost white, skin. Their religion is Shamonism. Natives of the coast tribes are often armed with rifles. They have plenty to eat and are independent. Old men and women when they become infirm are killed by their children, in response to imperative demands supposed to come from spirits.

A NEW TYPE OF AUXILIARY VESSEL FOR THE BRITISH NAVY.

One of the latest and newest acquisitions to the British navy was recently launched at Southampton. This is an ordnance vessel of very stout construction, specially built for the conveyance of heavy guns in reserve, and other ordnance stores. The hatch is of sufficient dimensions to accommodate the largest of

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naval guns, being 52 feet long, while the hold is 80 feet in length. The vessel is 165 feet in length between perpendiculars, its beam is 26 feet, and its molded depth, 13 feet 8 inches. The engines and boilers are placed aft and are protected by wing bunkers. The ship is provided with a long, raised quarter-deck 70 feet in length, and a forecastle deck 26 feet in length. The engines are of the triple-expansion type, with cylinders 13½ inches, 20½ inches, and 31 inches in diameter by 24-inch stroke, indicating 500 horse power. Steam is supplied by one large single-ended boiler, constructed for 155 pounds working pressure.

THE HALL-MARKING OF GOLD AND SILVER IN ENGLAND.

There are probably few countries where the gold and silver manufacturers and the public are so protected, and all possibility of fraud rendered abortive, as in Great Britain. In England, no plate manufacturer is permitted to sell, and no member would even attempt to purchase a piece of silver or gold plate, that had not received the "hall-mark." This symbol is stamped upon every section of plate, and is an absolute guarantee of the purity of the metal. "Hall-marking" is protected by the legislature. Fraudulent hall-marking is so heavily-punishable an offense, that attempts to deceive the public by means of spurious hall-marks are practically unknown. Probably few articles can be so easily adulterated as silver and gold, and were there no such protection as hall-marking in vogue, the public would be extensively defrauded, as the purity of the metals cannot be determined by cursory examination, but only by elaborate testing.

Hall-marking gold and silver plate in England is an exceedingly ancient custom. In the whole of the United Kingdom there are only seven government assay offices—four in England, two in Scotland, and one in Ireland. Although the principal office is the Royal Mint, London, the most important and busiest assay office is that at Birmingham, the center of the jewelry industry of England, where enormous quantities of articles are stamped every day. The first statute passed authorizing the stamping of gold and silver with its carat purity, was enacted over five hundred years ago, and the main principles then laid down, are still in vogue to-day. The wording of the original law was as follows: "Because gold and silver, which is wrought by goldsmiths in England, is oftentimes less fine than it ought to be; because the goldsmiths are their own judges, be it ordained that henceforth every goldsmith put his mark upon his work, and the assay of the Touch belongs to the mayor and governors of the cities and boroughs, with the aid of the Master of the Mint, if there be such, putting the mark of the city or borough where the assay is." During the course of years, owing to the mayors of cities having become more deeply engrossed in more urgent municipal affairs, the task of testing plate originally assigned to them, has devolved upon the Goldsmiths' Company.

The standard of purity is governed by the legislature. Pure metal is estimated at 24 carats. But pure gold articles, owing to the softness of the pure metal, would be of practically no use for commercial purposes, so a certain percentage of alloy is permitted, the carat value being reduced correspondingly. Formerly there was only one standard in existence, and all articles which were not equal to this standard were destroyed. But in view of the demand for plate articles containing various proportions of metal, five standards of gold and two of silver have been authorized by the government. The five old standards for gold are 22, 18, 15, 12, and 9 carats respectively, in an alloy of 24 carats. Every article submitted to the Assay Office must correspond with one of these standards; otherwise it is not stamped, but is broken to fragments and rendered unsalable.

The Birmingham Assay Office employs 190 hands, a large majority of whom are women. The amount of jewelry stamped is considerable, and the work is carried out with remarkable thoroughness. For instance, in the case of gold and silver chains, every link is assayed and stamped, yet the fee is only 10 cents in the case of a gold chain, and 3 cents for a silver chain. Owing to the heavy business transacted at this office, the fees levied for hall-marking are only approximately one-third of those authorized by the legislature. No hollow plate ware less than .0076 inch thick is stamped, this being the minimum thickness stipulated by the office. Thin wares need not be stamped, nevertheless the retailer, if required by his customer, must get his goods stamped.

The plate is brought to the institution in a practically completed state. The manufacturer stamps each article with his own initials, and indicates upon a statement what the gold or silver carat value of the articles deposited is supposed to be. The goods are deposited at the office in the early morning and are fetched in the evening.

The plate is then taken in hand by the assayers. The maker's initials are first compared with those registered at the offices, the articles are examined to see if they are quite complete, and also to ascertain if the amount of solder required to effect the necessary joints is not excessive. If these investigations prove satisfactory, a small portion of the metal is cut or scraped away, and this, which is called the "diet," is sealed up and reserved for the Master of the Mint, who periodically tests the metal and checks the work of the assayers. The article is then passed on to the testing room, where exactly five grains of it are weighed out with delicate scales, and wrapped in a thin sheet of lead ready for the assay.

There are two consecutive methods of testing gold, and two alternative processes for assaying silver. Formerly the metals were tested by simply rubbing the plate with a piece of hard, black, smooth stone, and then wetting the "touched" pieces with the tongue, which operation divulged the various tints that distinguish one rare metal from another. But this process is far too primitive nowadays, when metals can be so easily and closely adulterated, while too much also depends upon the judgment of the operator, for any reliable estimation of the purity of the metal to be gained, though it is still employed for certain purposes.

The testing process for gold, recognized by law, is that known as the "dry" process, but there is also another method known as the "wet," which is more efficacious and quicker than the former, and is indeed rapidly superseding it. The dry process is utilized in the testing of both gold and silver. The five grains of metal obtained from the article is rolled up in the small sheet of lead, and placed in a small cupel containing calcined bone. The vessel is then heated over a gas fire in an air furnace, the result of which operation is that the base metals alloyed with the gold or silver oxidize, and are absorbed by the calcined bone. The small pill of gold left in the cupel is then weighed, and by deducting its present weight from the five grains which it weighed before cupellation, the proportion of gold or silver in the plate can be ascertained. For testing silver by this dry method, nothing more is necessary, but as silver is alloyed with gold, a further operation is necessary to extract the silver from the rarer metal. The second operation is technically called "the parting," and consists of boiling the small pill of gold, which by the way has been treated with a quantity of silver to facilitate the dissolving of silver alloyed with the gold, in a platinum vessel containing nitric acid. This solution rapidly dissolves the silver, but exercises no effect upon the gold. When all the silver has been extracted from the gold, the latter metal is so brittle that it cannot be handled, and therefore has to pass through an annealing process, after which it is weighed, and, by comparing its present weight with the original five grains, a correct estimate of the quantity of gold in the assayed article is obtained.

In the "wet" testing process, so far only utilized for silver, the latter metal is plunged in nitric acid and dissolved, and solutions of iron and salt are added by means of graduated pipettes. Common salt may be employed, but better results are gained with sulpho cyanide. This test is based upon the principle that a certain quantity of salt solution will precipitate a certain quantity of silver before acting on the iron. Therefore, if the liquid in the glass vessel is not discolored by the iron, the vessel contains at least the standard quantity of silver. Then it is necessary only to compare the sample with one prepared for standard silver, and the assayer can immediately ascertain whether the sample is equal or below the standard.

After passing through the tests, the articles are stamped, or "hall-marked," as it is called. This process is simultaneous with the assaying. For gold articles, the standard marks are a crown and the carat number for the two highest carat standards—22 and 18 carats respectively—this number being followed by decimals representing the proportion of gold in the alloy for the 15, 12, and 9-carat quantities. The number is followed by the symbol or mark of the assaying office, which in the case of Birmingham is an anchor, while the year in which the assay was made is represented by a letter. At last come the manufacturers' initials. Although the hall-marks are stamped boldly upon the article, some makers are agitating for them to be imprinted with still bolder marks, and also for the addition of further marks, as customers are always guided in the choice of wares by the hall-mark, knowing full well that the article is as represented, and that no fraud is being practised. By the foregoing series of marks it is possible to ascertain by reference to the hall-mark, the manufacturer, the year of assay, quality of gold, and the office in which the article was assayed. Last year 407,698 ounces of gold, and 3,272,950 ounces of silver were hall-marked at Birmingham.

Every article submitted to the Assay Office is returned marked. If it does not correspond to the manufacturer's statement of the carat value, it is smashed to pieces, and returned to the manufacturer, in fragments to be remade. Under no circumstances whatever is gold or silver plate delivered from the Assay Office without the hall-mark. If a private person wishes to ascertain the carat value of a piece of gold or silver plate, procured abroad, and submits it to the Assay Office to be tested, it is duly assayed, and the owner informed of its carat value, but if it does not correspond to one of the standards, no matter what its value may be, it is smashed and returned to the owner in pieces. Last year 2995 ounces of gold plate, and 3804 ounces of silver plate were destroyed for being under the manufacturers' statement values.

Extreme precautions are observed to prevent fraudulent hall-marking, or the stamping of articles with a higher carat mark than they actually are; and to prevent ruthless breaking owing to deficiency in carat value. One assay master and two warders are compelled by law to be present when any plate is being marked or broken. To prevent tampering with the hall-marking dies, they are always kept in a strong box, whenever they are not in use, fitted with three different locks, the key of each lock being retained by one of the trio. These precautions are absolutely necessary because the manufacturer is entirely at the mercy of the assayers. The manufacturer suffers no loss from the abstraction of the "diet" for the master of the mint, but the amount is voluntarily surrendered by the office.

SCIENCE NOTES.

Through the liberality of George W. Perkins, of New York, an expedition was sent by the New York Botanical Garden to Nova Scotia and Newfoundland. The expedition has secured 12,000 specimens of over 2,000 species of plants. A third of the specimens are marine plants.

The recent expedition sent to north Montana by the New York Botanical Garden has done much in the interest of scientific botany. Many Alpine forms of plants were discovered. Ample statistics were secured establishing the variation of plant life caused by temperature and latitude, and of the general vertical distribution of flora.

Recently at an auction sale in London which was judiciously advertised, an egg of the great auk was put up which after some lively bidding was knocked down for $1,260. That is said to be a very good price. But auk eggs have been sold in London for as much as $1,500. The reason for these enormous prices is naturally to be found in the scarcity of the eggs. The bird is extinct, and not over seventy of its eggs are in existence.

Charles Rothschild has, perhaps, the most curious museum of any collector in Europe. At Tring Park he keeps thousands and thousands of fleas. The museum is in charge of Dr. Jordan. Every animal and bird has its particular kind of flea. Very many have several different kinds. It clearly follows that the gathering of fleas affords diverse material for the collector. In the Rothschild collection is one mole flea (*Hystrichopsylla talpæ*) a fifth of an inch in length.

Charles Gilmore, of Laramie, and E. B. Cavell, who have been at work all summer in the fossil fields at Medicine Bow for the Carnegie Institute at Pittsburg, have dropped their work for the winter. The summer netted them about a carload of fossils, which will be shipped to Pittsburg. The finds were numerous and valuable, though no astonishing results followed their labors. Walter Granger, who is at work in the Medicine Bow field for the American Museum of Natural History of New York, also has a carload of fossils to go forward, but he will remain in the field for time being. He reports a large number of curious and valuable finds, and expects to return to this field next summer.

Hungarian dentists and chemists claim to have discovered a valuable local anæsthetic, an alkaloid, nervocidine, the hydrochloride of which is stated to have similar properties to cocaine, but to produce a much more lasting anæsthesia. The base is obtained from an Indian plant, "Gasu Basu," the properties of the leaves of which were first discovered by D. Dalma, who successfully employed them in painful pulpitis with such good results that he reported that the drug might displace arsenic for dental purposes. B. von Fenyvessy has investigated the properties of the alkaloidal hydrochloride, as prepared by Dalma, which is a yellow, amorphous, hygroscopic powder, readily soluble in water. It produces marked anæsthesia of the cornea in 0.1 or 0.2 per cent solution, which is very persistent, and a 0.1 per cent solution brushed on the mucous membrane of the cheek also gives marked anæsthesia. Stronger solutions, exceeding 0.5 per cent, produce irritation of the cornea, and a 2 per cent solution causes ulcerative keratitis in dogs and rabbits, which lasts ten days, during which period the anæsthesia also lasts. It does not appear to produce anæsthesia by subcutaneous injection. Its general effect is that of a paralyzing poison. Although its anæsthetic effect is much more prolonged than that of cocaine, the length of time necessary before this effect supervenes, the irritation caused by the drug, and the toxic symptoms it produces, do not point to the probability of its being of general service, except perhaps in dental practice.—Lancet.

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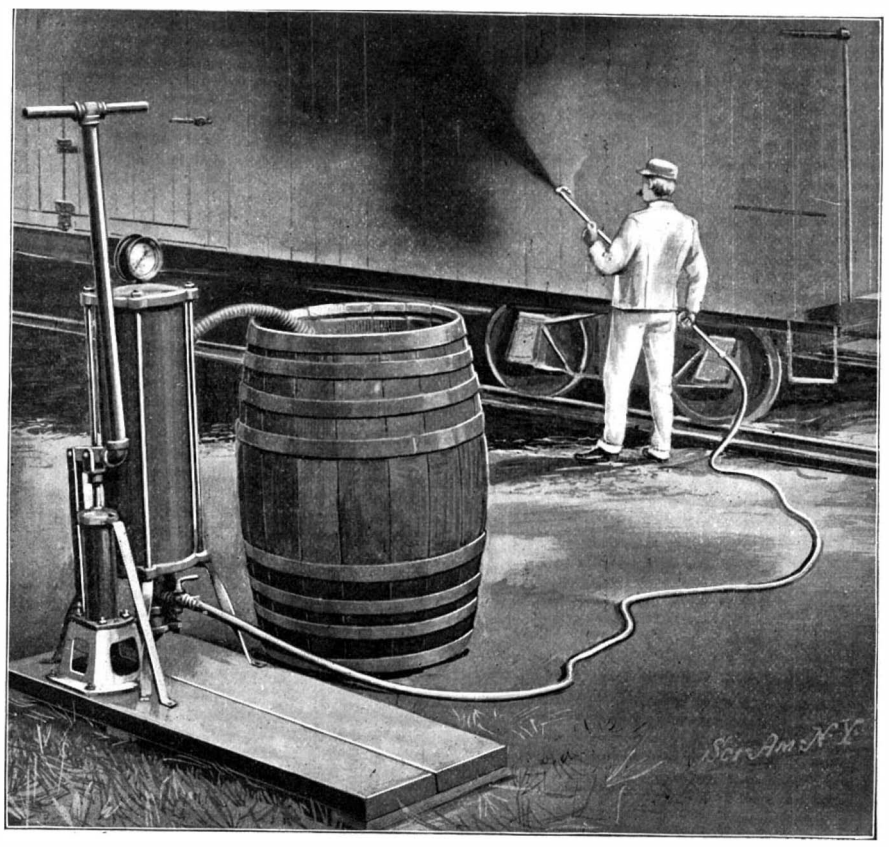
A PNEUMATIC COATING MACHINE.

Pneumatic painting has within recent years developed to such an importance that a description of the machine by which the work of coating a surface is performed may not be without interest to our readers.

The machine, as it is manufactured by its originator, Mr. F. E. Hook, of Hudson, Mich., comprises a self-contained air and liquid pump, fitted with a special expansive plunger, and an eight-inch boiler-tube receptacle in which the liquid and air are compressed. The apparatus thus comprised is mounted upon a substantial platform. Attached beneath the receptacle are two valves, located one above the other at one side of the pump in a special valve-chamber, and playing in removable brass seats and cages. The suction-opening at the under side of this valve-chamber is L-shaped. Into the L thus formed is screwed a piece of one-inch pipe to which the wire-wound suction hose is attached. The suction opening leading into the pumping-cylinder is placed about one and one-half inches above the bottom of the cylinder, and is connected with the lower valve chamber. It is the object of this construction to allow the plunger to close the suction-opening on each down stroke, thereby crowding every drop of liquid or air through the upper valve into the receptacle. From this construction, it follows that the liquid can never come in contact with the packing of the plunger. Indeed, the liquid does not enter the cylinder at all, because on the upper stroke of the cylinder the lower valve is opened and the liquid is drawn through into the lower valve-chamber. The down stroke, whereby the lower valve is closed and the upper valve opened, forces the liquid through the upper valve into the receptacle.



PAINTING A FREIGHT CAR WITH THE PNEUMATIC COATING MACHINE.

The plunger is so arranged that it can be withdrawn through the top of the cylinder by removing two bolts. Furthermore, it can be instantly expanded without necessitating its removal from the cylinder, simply by disconnecting it from the fulcrum, forcing it into the bottom of the cylinder, and tightening the plunger-rod. The discharge-opening, which is controlled by a special valve, is located at the extreme lower end of the receptacle, the bottom part of which is oval, so that every drop of the liquid is forced out of the receptacle.

Any length of pneumatic air hose can be used; for when the discharge valve is open the hose becomes a part of the receptacle, increasing its capacity to the extent of the additional volume of the hose. By means of an eight-foot extension rod or tube the liquid can be spread fourteen to sixteen feet overhead without a scaffold or ladder. Within this extension rod is another valve, which gives the operator complete control of the discharge, even though he is working one hundred feet away from the machine. A specially designed nozzle at the end of the extension rod gives to the liquid a whirling motion, so that there is no possibility of clogging the outlet. This special nozzle, in connection with the compressed air, atomizes the liquid so that a fine, filmy mist is formed which penetrates everywhere.

The merits of the construction of the machine are obvious. The pump has simply to compress the liquid and air, and is not used as a means of discharging the liquid. The air, confined above the liquid, forces the liquid out through the discharge-hose and nozzle, so that if the machine is charged with liquid and air, it is not necessary to operate the pump handle in order to empty the receptacle. The chemicals in the liquid cannot reach or destroy the plunger-packing; for they do not pass through the plunger. Since the valves are located at one side of the plunger, they cannot become clogged with sediment. By providing concave seats and giving the valves a rolling motion, each stroke of the handle cleans the valves. The air pumped in while the receptacle is full of liquid passes to the top of the receptacle, thereby stirring or agitating the liquid constantly. By spreading the liquid into a thin mist through the medium of a special nozzle it is possible to apply a coat more evenly than otherwise and without the streaky appearance given by the brush.

Contrary to the prevalent opinion, the pneumatic coating machine is clean. If the filmy mist falls to the floor, it is hardly noticeable. In painting by brush, huge drops often fall to the floor. The application of the machine is wide, but has found its chief use in warehouses, factories, and for painting large surfaces of any kind. whether they be rough or smooth. In painting rough surfaces the saving in time and labor is particularly marked; for the fine spray permeates every crevice, and the work is far better done than it could be by hand and brush.

DREDGER FOR LEVEE BUILDING.

BY ENOS BROWN.

At the junction of the Sacramento and San Joaquin Rivers with San Francisco Bay are large tracts, millions of acres in extent, known as "tule" lands. With each succeeding flood these lands are submerged, but as the waters subside vegetation of the rankest character quickly appears and develops with a profusion and luxuriance surpassed nowhere else in the world. The soil is composed of alternate layers of vegetable mold and silt, deposited by the rivers, and when reclaimed has proved of extraordinary fertility, producing crops of grain, potatoes and other vegetables that surpass belief. To reclaim all the tule lands is a task involving so great an outlay of capital as to be beyond the financial capacity of the present generation. But much has been accomplished in this direction, and at the present time some hundreds of thousands of acres have been leased and placed beyond danger from the yearly floods. The method employed in building these levees consists in scooping the soil from the channel of adjacent water courses and depositing it upon the boundaries of the land to be reclaimed. The levees vary in height with large base dimensions, and are calculated to resist a heavy pressure from the outside. The lands are kept dry by a system of intersecting trenches draining the water into a depression from which it is pumped by steam power.

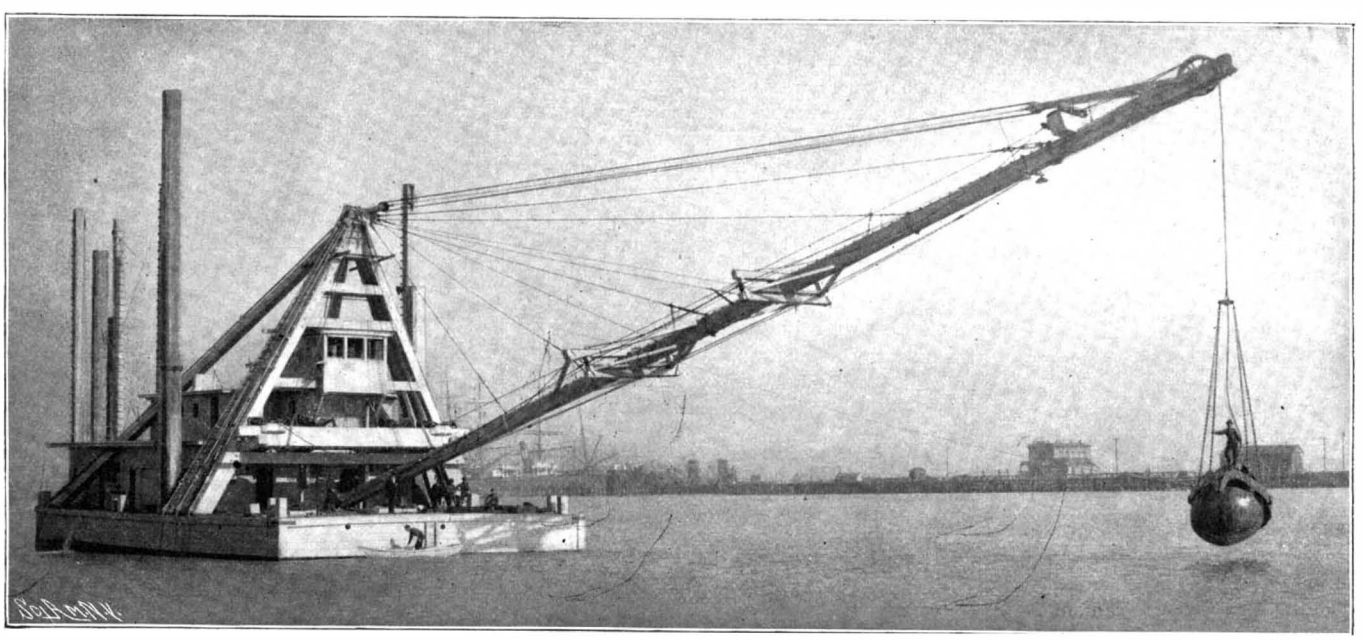
A dredger, claimed to be in some respects the largest ever constructed, has just been completed by the Golden Gate and Miner Works of San Francisco. It is designed for building a levee on one of the most considerable of the islands in the Sacramento River delta. The boom is of extraordinary length and describes a circle having a diameter of 310 feet, allowing the employment of material at great distance from the shore line, and thus lessening the danger from sliding banks.

The dredger is of the common "clam shell" type with hull 140 feet long, 50 feet wide and 11 deep, built of 12 by 12 timbers. It has two longitudinal bulkheads extending from cross keels on to deck timbers, and two cross bulkheads constructed of 12-inch square timbers.

There are three stationary spuds and one fleeting spud, each 30 inches square and 70 feet long. The engine is of the double cylinder compound high-pressure type, with two 14-inch cylinders working into a low-pressure 41-inch cylinder. The horse power developed is about 500.

The boilers are 7 feet high and 13½ feet long, of the Scotch marine type. Oil is the fuel employed.

The boom is 155 feet in length, constructed of 24-inch timbers spliced in the center. The bucket is unusually large, with a spread of 14 feet; though denominated a six-footer, it has raised in one lift a load of 14 cubic yards, weighing 25 tons (see illustration), of soil composed of sand and clay such as the beds of California rivers in lowlands consist of. One round trip of the bucket is made in 60 seconds, and in a day's work of 22 hours the dredger can handle 10,560 cubic yards of material, though the average of day's work is about 8,000.



A GIANT DREDGER. THE BUCKET HOLDS 25 TONS; AND THE BOOM IS 155 FEET LONG.

A New English Submarine Boat.

The submarine boat "A 1," built by Vickers Sons & Maxim and the Admiralty, was tested in deep-sea experiments in the Irish Sea recently.

After several days' speed trials at the Barrow Docks the vessel was towed out before daylight to about five miles from Walney Island. Large casks with flags were laid down for a long course, and soundings were taken for several miles in the vicinity. A heavy sea was running, and there was a thick mist.

The boat was quickly submerged and traveled several miles, not returning to the surface for some hours. A depth of from ten to fifteen feet was obtained. Maneuvers in and out the flag marks showed that the vessel answered her rudder with great rapidity in whichever direction it was desired to go. She was brought promptly to the surface on several occasions and was submerged with equal rapidity. The surface trials were then run and the speed showed considerable improvement over boats of the Holland type. The naval authorities maintain the utmost reticence, making it impossible to obtain accurate details. It is believed that the "A 2," "A 3" and "A 4," which are now being built, will be more formidable than any with which trials have been made by foreign powers. The "A 1" returned to Barrow after dark. It is believed she will be fitted with a new petrol engine for the purpose of charging her electric batteries and propelling her on the surface with greater speed than has hitherto been obtained.

It is claimed by the builders that this new vessel is far more powerful and efficient than the American boats of the Holland type.

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TRANSPORTING THE 16-INCH GUN TO SANDY HOOK.

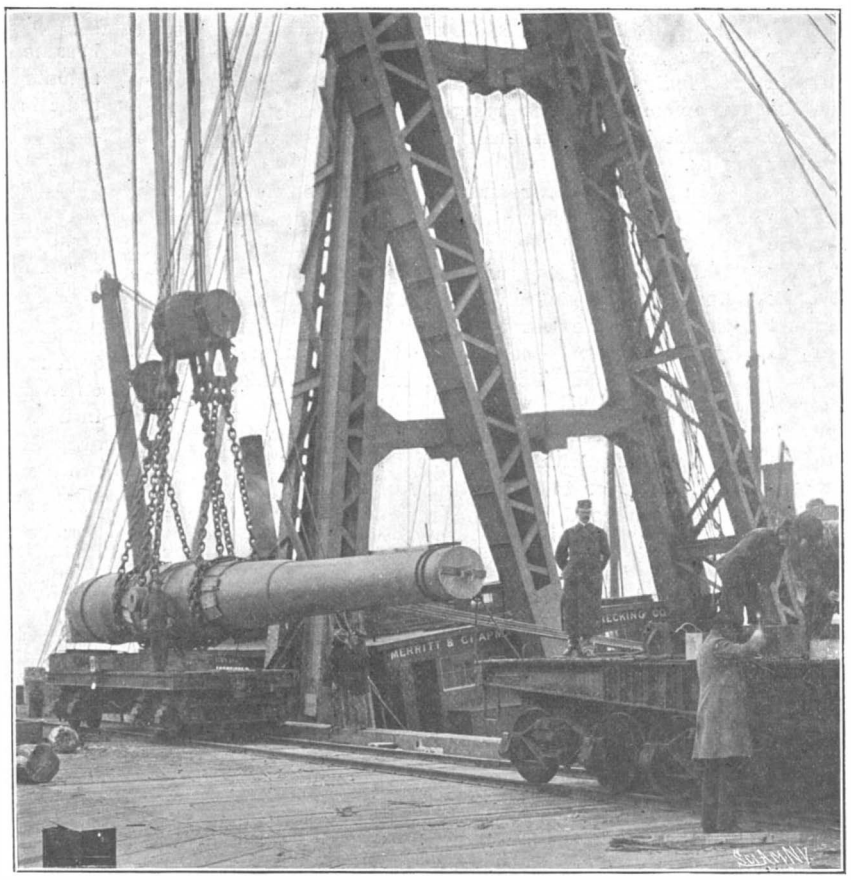
After over half a decade being spent in its construction, the new army 16-inch gun has at last been completed and shipped from Watervliet Arsenal to the Government Proving Ground at Sandy Hook. The task of moving this great piece of ordnance was no easy one. The gun itself weighs about 300,000 pounds, and during its construction about 68,000 pounds were removed from the rough forgings in the process of turning down and boring out the various tubes, hoops, etc., of which the gun is built up.

This unwieldy and somewhat out-of-date piece of ordnance was designed for sea-coast defense. The Endicott Board, in providing a general scheme of sea-coast defenses for the United States seaboard, proposed that in addition to a large number of breech-loading rifles of smaller calibers, the defenses of New York should include no less than eighteen of the 16-inch guns. It was also proposed to mount ten of these guns at San Francisco and four at Hampton Roads. The piece which is now at Sandy Hook was constructed as a test weapon, the intention being, if this should prove satisfactory, to push through the completion of the other guns. Although in England and Italy there are to be found guns of somewhat larger caliber than this, they are not so powerful. The Italian gun of 17.75 inches caliber throws a projectile weighing 2,000 pounds, with a muzzle velocity of 1,700 feet per second, and a muzzle energy of 40,000 foot-tons. The English Armstrong gun of 16.25 inches caliber throws an 1,800-pound projectile with a muzzle velocity of 2,100 feet per second and a muzzle energy of 51,000 foot-tons. The new 16-inch gun of the army was originally designed to be fired with the old brown powder. It is calculated with a powder pressure in the chamber of 37,500 pounds per square inch, the gun will throw a projectile weighing 2,370 pounds, with a muzzle velocity of 2,300 feet per second, and a muzzle energy of 88,000 foot-tons; but in the forthcoming tests of the gun at Sandy Hook, the actual velocity secured will depend upon the particular quality of powder that is used. In any case, the results of the trial will be watched with great interest by artillerymen, not only in this country but throughout the world.

It will be seen from the accompanying photographs that the gun does not differ in external appearance from the standard, heavy, breech-loading rifles of our army. It consists of a long inner tube, a heavy jacket inclosing the tube and extending from the breech to a distance of about 6 feet beyond the trunnions, a series of chase hoops reaching from the jacket to the muzzle, and the jacket hoops which inclose the jacket and extend from the breech for about one-half the length of the gun. From breech to muzzle the gun measures 49 feet 3 inches; its diameter at the breech is 5 feet, and at the muzzle 2 feet 4 inches. The projectile is 5 feet 4 inches in length and 16 inches in diameter, and it weighs 2,370 pounds. With a velocity of 2,300 feet at the muzzle, it will penetrate 42.3 inches of steel.

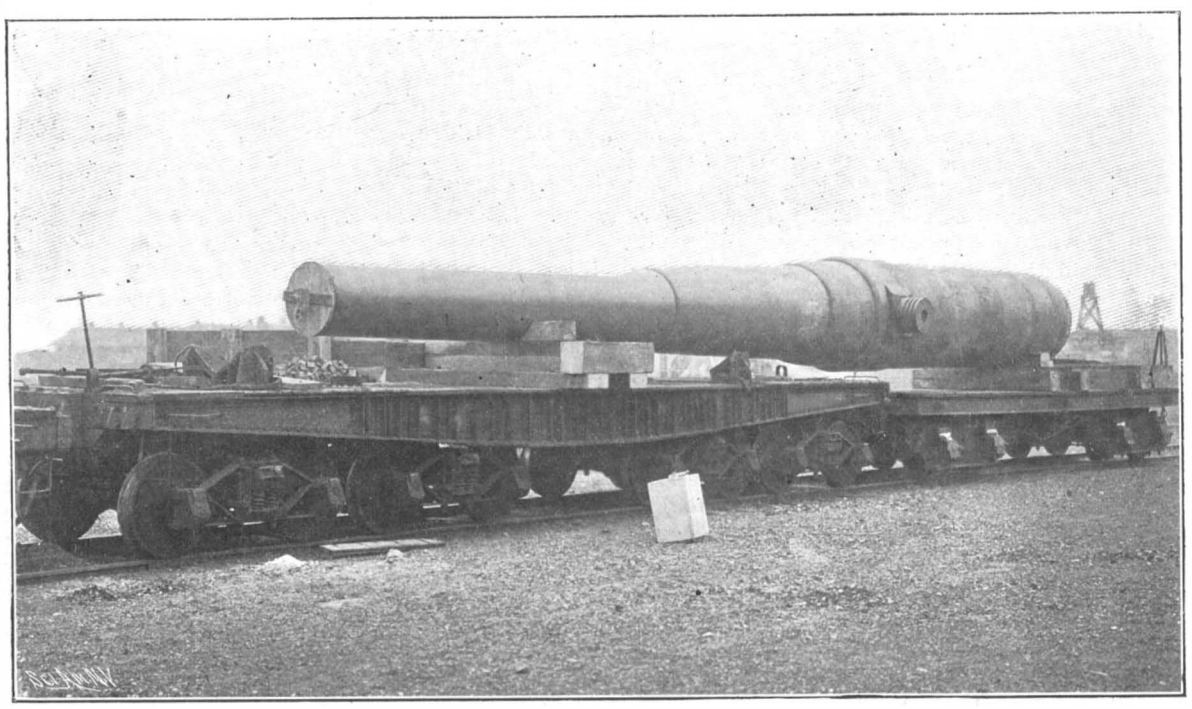
Major J. M. Ingalls, for many years instructor at the Artillery School for Officers at Fort Monroe, Va., has calculated the trajectory of the projectile when the gun is given an elevation of 40 degrees, and the velocity at the muzzle is 2,300 feet per second. The extreme range would be 21 miles, and the maximum elevation obtained by the shell in covering this distance would be 30,516 feet. That is to say, if Mont Blanc were placed upon Pike's Peak, the 16-inch shell would pass entirely clear of the two mountains, and would descend to the earth at a point 21 miles distant. To further show the great theoretical range of this piece, we may suppose the gun to have been set up at the Battery, New York, and mounted in a carriage which would allow of an angle of elevation for firing of 40 degrees. If the gun were fired to the north, it would throw its shell considerably beyond New Rochelle on the Sound, while Tuckahoe and Hastings on the Hudson could be bombarded. The circle of its zone of fire would include Hempstead and Long Beach on Long Island, while to the southwest it could throw its shells half a mile beyond the Atlantic Highlands. Keyport and Perth Amboy, Westfield and Millburn in New Jersey, would be within reach, while its huge projectiles would pass far overhead above Orange, to fall some seven miles distant in the valley beyond.

In transporting the gun to Sandy Hook, a special car with very heavy trucks was prepared to take the gun to tidewater on the Hudson River. Here it was transferred to the deck of a large floating derrick owned by the Merritt-Chapman Wrecking Company. The lifting capacity of the derrick is 250 tons, and consequently there was a wide margin over the weight of the gun, which is, as we have stated, about 300,000 pounds. The gun was then towed down the Hudson River to the Erie Basin, and from thence to the government wharf at Sandy Hook, which had been specially strengthened for its reception. Here the gun was transferred to its special car, which had been brought down on the barge with the gun.



TRANSFERRING THE GUN FROM THE CARS TO THE 250-TON FLOATING DERRICK.

For the testing of the gun it will be necessary to provide a special mount. Just what kind of a mount will be used has not yet been determined, and, indeed, it is something of a problem. The heaviest guns at present in use in the army weigh about 64 tons, and it will be understood that a piece of more than double that weight, with considerably more than double the energy, will require a very special mount for testing. It has been suggested that the mounting used in the test of the Gathmann gun might be remodeled for the purpose; but we fail to see how this could possibly be done. As a matter of fact, the development of modern ordnance has been so rapid that the 16-inch gun is quite out of date, and however successful the test of it may be, it is certain that its mate will never be built. The tendency to-day is toward the construction of lighter and longer weapons, with much greater rapidity of fire, with flatter trajectory, and firing high explosive shells.



THE 16-INCH GUN ON SPECIAL CARS FOR TRANSPORTING FROM THE ARSENAL TO THE HUDSON RIVER.

Sverdrup's Discoveries.

The long dispatch sent by Capt. Sverdrup from northern Norway, says the New York Sun, conveyed no exact idea of the lands he found to the west of Ellesmere Land and Grinnell Land in the hitherto unexplored region north of the Parry Islands. Later information shows that Sverdrup discovered two land areas that are comparable in size with some of the larger known islands north of this continent.

He found, in the first place, that the south coast of Ellesmere Land extends some seventy miles almost due west of the point where it was supposed by Inglesfield to turn to the northwest. The south coast has, therefore, doubled the length heretofore represented. Sverdrup thinks the earlier explorers were deceived in mapping Cape Eden and the Victoria Islands on this supposed northwest coast by the mountains of Ellesmere Land peering above masses of fog.

The south coast thus extends nearly to the island of North Kent, from which it is separated by a strait about two miles in width. Northeast of North Kent Sverdrup found that Ellesmere Land is greatly narrowed by a very deep and wide bay penetrating far to the east. Following the west coast along the very winding shore line he found a narrow channel about 200 miles in length, which washes the shores of northwest Ellesmere Land and southwest Grinnell Land on the east and a hitherto unknown shore line on the west. This new land, which may consist of two or more islands, extends about 200 miles north and south. Its western shores were seen for sixty or seventy miles north and south of the seventy-ninth parallel, so that the land mass in that region has an extension east and west across six degrees of longitude.

To the west of this large land and north of North Cornwall, the most northern land in these seas known up to the time of Sverdrup's explorations, another great land mass was discovered and a sledge journey was made clear around its coasts. It extends to the northwest from about the seventy-eighth to the eightieth parallel, or about one hundred and forty miles. It is oblong in shape, and its mean width may be seventy to eighty miles. Its coasts are deeply indented and it may consist of two islands.

These discoveries show that land extends far to the north of the Parry archipelago, and that the new land masses are larger than any among that group of islands.

No land was seen to the north or west of these islands; but there is no ground for asserting that more land does not exist there, and that the American Arctic archipelago is not very much larger than the land areas thus far shown on the maps.

The British Admiralty committee on torpedo boat destroyers began an investigation on November 28 into the weakness of the backs of torpedo boats by making efforts to break the torpedo boat destroyer "Wolf" in half. The experiment is the most remarkable and, perhaps, the most costly ever taken for naval research. The cost of building the "Wolf" was $1,250,000.

It is likewise designed to test the effect of wave action upon destroyers. The accident to the "Cobra" seemed to show that the back breaks when a wave lifts the boat amidships, or when she is lifted in such manner that the wave is hollowed beneath her middle. The "Wolf" was alternately hung in the dock by the bow and stern in special cradles having no support amidships. Then she was hung by the midship section without the ends being supported. The result has not as yet been published. It goes without saying that the data secured will be of immense value in the designing of future destroyers.

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NEW YORK AND BROOKLYN RAPID TRANSIT SUBWAY.

The new section of the Rapid Transit Subway now under construction from City Hall Park, Manhattan, to Flatbush and Atlantic Avenues, Brooklyn, is in some respects the most important link in the whole rapid transit subway scheme. Indeed, it was only the restrictions imposed by what is known as the "debt limit" that prevented the Rapid Transit Commissioners from incorporating this section in the original contract for the Subway. As soon, however, as the legal borrowing powers of the city permitted, tenders for the construction of this line were invited, and the contract was let in the present year to the construction company which has the first work in hand. Such excellent progress has been made on the first contract, that it is confidently expected by the contractors that they will have trains running over the greater part of the road by the first of January, 1904. As the result of the introduction of a new system of construction for the side walls and roof of the Subway, it is expected by the contractors that they will have the new line finished from City Hall Park to the Battery in eighteen months time. The tunnel beneath the East River will take about three years to construct.

The new extension, which will be a two-track structure, will start from the end of the present Subway at the intersection of Park Row with Broadway, and it will extend beneath Broadway to the Battery, where there will be a loop for the use of the Manhattan trains, that will make the return trip to Harlem and beyond. On this portion of the line there will be four stations: at Fulton Street, at Rector Street, Bowling Green, and on the loop at South Ferry opposite the Staten Island Ferry terminal. In some particulars the construction of the Broadway line will be similar to that of the Subway already built. The new method of construction will be applied to the roof of the Subway, which, instead of being composed of steel I-beams placed transversely to the line of the Subway, with concrete arches turned in between the I-beams, will be formed of a mass of concrete of uniform thickness with 1¼-inch steel bars embedded in the concrete near its under and upper surfaces. These bars will lie transversely to the center line of the Subway, and will afford the necessary tensile strength to the concrete mass. The side walls will be of the same construction as in the completed Subway, and will consist of vertical I-beams, spaced 5 feet apart, with concrete arches between them, and a backing of brick or terra cotta, as the case may be. The I-beams will be retained in the side walls down Broadway, in order to provide unyielding abutments for shoring the foundations beneath the tall buildings that line that thoroughfare.

The southerly end of the Bowling Green station platform will be located on the west side of State Street, about opposite the center of the new Custom House, and at this point will commence the terminal loop, which will extend below Battery Park, as indicated on the accompanying plan. The station will be on the outer side of the loop, and in general will lie opposite the terminal stations of the various ferries that center at South Ferry. There will be two tracks throughout the loop, the outer of which will be devoted to the through travel, the inner tracks being used for the storage of trains.

At the point where the loop commences, the two tracks of the Brooklyn connection will switch off from the Broadway tracks, and will be carried through the loop in a separate tunnel, on a descending grade to pass beneath the East River. These tracks will lie in a single tunnel until they approach the South Ferry station, when they will separate and each track will be carried in its own tube until the Brooklyn shore is reached, when they will unite again in a single tunnel. This arrangement is shown very clearly in the plan and in the large sectional view taken through the station and through the two East River Tunnel tubes.

Considered as a transportation center, South Ferry, already an important point, will become one of the most important points of concentration in the world. The situation is shown very clearly in the front page drawing referred to. In the first place, we have the elevated system, which here receives and dispatches its trains from and to the four great arteries of elevated travel that extend through Manhattan Island. Immediately below these is the stopping and starting point for the cars of the great Metropolitan Street Railway system; while in the next plane below them will be the station of the Rapid Transit Subway, through which will pass the subway traffic of the Bronx and Manhattan Island, and also the suburban cars of the New York Central, Harlem, and the New Haven Railroads. In the fourth plane of travel we see the two tubes of the Brooklyn extension, through which will circulate the traffic between Manhattan and Long Island. The East River tunnel tubes will descend on a grade of 3.1 per cent until they reach the center of the East River, when they will rise on the same grade to enter Long Island beneath Joralemon Street. In Brooklyn, the subway will pass below Joralemon Street to the Borough Hall, where there will be a station; it will then pass beneath Fulton Street with a station at Hoyt Street, to Flatbush Avenue, where there will be another station, and will continue up Flatbush Avenue to a station at the junction of Flatbush and Atlantic Avenues. The construction of the tubes beneath the river will differ according to the quality of the material that is passed through. Where the excavation is through rock the tubes will be built of sheet steel, with an internal lining of 15 inches of concrete; but where the excavation is through sand or gravel, or any of the softer materials, the tube will be built in sections of segmental, heavy, cast-iron plates, with strong internal ribs, the sections being strongly bolted together as construction proceeds, and the completed tube being lined internally with beton, which is filled in flush with the inner edges of the ribs.

In conclusion, reference should be made to the added importance which is given to this loop, and also to the loop which has been constructed below City Hall Park, by the announcement of the New York Central and Hudson River Railroad Company that they intend to run two connecting tracks from their system at Forty-second Street, to connect with the Subway under Fourth Avenue. By this connection the suburban trains of the New York Central, the Harlem, and the New Haven roads, which are to be operated electrically, will be able to proceed to City Hall Park, or to the Battery, or to Brooklyn, as may be desired, and suburban residents living as far out as Peekskill, White Plains, and Portchester, will be enabled to travel from their respective homes to their places of business in New York or Brooklyn without change of cars. It is but due to the engineers of the Rapid Transit Commission to state that the possibility of a connection of the New York Central tracks with those of the Rapid Transit Subway is due to their forethought in making special provision for this connection at Forty-second Street and Park Avenue. With a view to accommodating the tracks from the New York Central Road, the Rapid Transit Commission engineers separated the two-track tunnels which run beneath Park Avenue from Thirty-fourth Street to Forty-second Street, and swung them over to right and left, leaving room for future tracks between them. At the same time they suggested to the New York Central Company the advisability of making this connection; and although the latter company rejected the overtures at that time, they have recently announced that as part of the scheme for depressing their terminal station at Forty-second Street, they are contemplating the construction of two tracks from this terminal, to connect with the Rapid Transit tracks on Park Avenue between Thirty-fourth and Forty-second Streets. The importance of this work, and the advantage of having the Subway tunnels located in such position that the connection of the two systems can be carried out at once, will be evident.

Opening of the Nile Reservoir.

The great Nile reservoir and dam were opened on December 10, in the presence of the Khédive.

The opening ceremony took place in the afternoon, when the Khédive turned a key which put the electric machinery in motion, whereupon the sluice gates were opened and a great body of water rushed through them.

The Duchess of Connaught then laid the last stone of the dam.

It is estimated by Lord Cromer, the British Agent in Egypt, that the Assouan dam, which has cost about $12,500,000 will increase the agricultural earning power of Egypt $13,000,000 every year—in other words, that it will pay a percentage of over 100 every twelve months. The dam will permit the additional irrigation of 1,600,000 acres, and it is estimated that it will provide an additional revenue to the Egyptian government of $1,900,000 a year.

The Current Supplement.

German electrical machinery for iron and steel plants is the subject of a copiously illustrated article treated by Mr. Frank C. Perkins, in the current SUPPLEMENT, No. 1407. Other articles on electricity deal with electrical waves and the human brain, and the deterioration of storage battery plates. The Manhattan-Brooklyn branch of the Rapid Transit Subway, treated on another page of the SCIENTIFIC AMERICAN, is fully discussed. Automobilists will doubtless read with interest an account of the Charron, Girardot, and Voigt Gasoline Automobile. Mr. R. L. Ardrey historically surveys the harvesting machine industry. Another article of historical interest is a chronological account of the piano and organ. Wood paving is made the subject of a paper by Mr. B. T. Wheeler. "The Animal Worship of Ancient Times" is the subject of an article which deals with many curious customs, which will doubtless be of unusual ethnological interest. In his presidential address to the Belfast meeting of the British Association for the Advancement of Science. Prof. James Dewar incidentally discussed the attitude of Tyndall toward evolution.

Automobile News.

Mr. Edge believes it would be an excellent thing to search for a substitute for the pneumatic tire, which is the cause of a great deal of the trouble encountered in automobiling. But whatever device may be taken up in its place, it must not only minimize the effect of jolting upon the occupants of the automobile, but also relieve the engine from the strains which the pounding of hard tires upon a rough road would impose.

As a result of the failure of the human time-keepers at the Deauville races, when one of the stop-watches became deranged and lost seven seconds, thereby much astonishing the world by new records, some new automatic apparatus has been considered necessary. Among the devices of this character which have recently been proposed is an electrical time-keeper. The apparatus consists of a box containing a chronometer regulated to work without gaining or losing. The mechanism includes toothed wheels, which unwind a reel of thin tape or paper marked off in millimeters.

A device which does not seem to receive from the makers the attention which it merits is the sprag, the iron rod suspended from the rear axle to hold the car on a grade in case brakes do not operate or are not in use. Too often the sprags fitted to heavy large cars are altogether too slender for the purpose; often they are stout enough, but so short that the car would be certain to ride over them. It is not often that the sprag is needed, but when it is wanted the need is great and immediate, and not only the car, but the lives of its occupants may depend upon the apparently insignificant device.—N. Y. Times.

The first section of steel roadway proposed by Gen. Roy Stone before the Automobile Club last March was laid recently in Murray Street between Broadway and Church Street. Another half-mile section is to be laid shortly uptown on St. Nicholas or Seventh Avenue, and a third section will afterward be put down in the suburbs. Thus the new roadway will receive a thorough test under all kinds of traffic. The mile of specially rolled steel rails was presented to the Club by Mr. Schwab, and is being laid at the Club's expense under the supervision of Major F. B. Jones, U. S. A. Full particulars of this novel form of roadway were published in SUPPLEMENT No. 1371.

In an interview with a representative of the European Herald, S. F. Edge, the winner of the Coupe Internationale, made some remarks that should be of interest to every chauffeur. He stated that the great value of the pneumatic tire is its absorption of the obstacles to speed offered by the ordinary road. Every time a solid tire strikes an object in the road, there is more work for the engine to do, and a consequent loss of speed. A pneumatic tire, on the other hand, leaps over a stone or ridge in the road, the tire allowing the obstacle to sink into its elastic surface. Thus, the amount of power necessary to surmount the obstacle is diminished. It might be thought that it surely would not take much power to lift an automobile over such stones and ridges as may be encountered in an ordinary road; but when it is considered that an automobile at high speed frequently covers 40 yards in a second, and that many such little obstacles would probably be found in this distance, it is evident that with no pneumatic tires to lift the automobile over them there would be a serious decrease in the efficiency of the engine and a consequent falling off of speed.

Roller chains, according to the Mechanical Engineer, when used on automobiles, require regular attention to keep them in good order. Carefully cleaned and lubricated, and properly adjusted, they will run with smoothness and absence of sound. A writer in a contemporary describes a method which he has adopted with success, as follows: Every 200 or 300 miles, more or less, according to the weather experienced, the chains should be removed from the car and soaked in a flat dish filled with kerosene. If moved about in this bath all dirt and stale lubricant will quickly be removed, and the chains can then be hung up to drain. It is a good plan to have a false bottom of perforated zinc to the bath, so that the dirt may sink through it, leaving the kerosene clean and clear for future use. The chains should then be transferred to another tray containing thick grease, and placed on a stove. As the grease melts, the air in the links of the chains will be driven out by the heat and replaced by the lubricant. When the air ceases to rise to the top in bubbles, the tray can be removed from the fire and allowed to partially cool, when the chain should be lifted out, hung up, and well wiped over, to remove the superfluous grease. Chains treated thus, the writer states, will run quietly and smoothly for a considerable distance, will attract very little dust, and outlive those treated by any other method. Any good grease can be used, but the best consists of sperm oil, in which sufficient beeswax has been dissolved to render it, when cold, of the consistency of the ordinary grease sometimes used in change speed gear boxes. A small quantity of best powdered graphite may be added with advantage.

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Correspondence.

Fire Peril of Brooklyn Bridge.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your article "The Lesson of the East River Fire," in the issue of November 22, 1902:

Many years ago I called attention to the danger which exists in the case of the Brooklyn Bridge. Should the buildings on either side of the river, which are under the bridge, burn, I believe that the bridge would almost certainly fall. The rapid diminution of the tensile strength of steel, under high temperatures, could only result, it seems to me, in this case, in a disaster of the first magnitude.

Have you ever noticed the close proximity of some of the buildings to the bridge cables?

F. E. CHADWICK,
Captain U. S. Navy.

Naval War College, Newport, R. I., Nov. 29, 1902.

[The danger indicated by our correspondent is a very real one, and it is nothing to the point to urge that, because no damage has been done to the bridge by fire, during a quarter of a century, therefore the risk is more imaginary than real. The true point of view is that of gratitude that among the hundreds of fires that occur annually in the lower part of the city, there should never have been a serious conflagration among the buildings referred to by Capt. Chadwick. We hope to refer to this matter at fuller length in a later issue.—ED.]

Typesetting With an Ordinary Typewriter.

To the Editor of the SCIENTIFIC AMERICAN:

Herewith an idea which I believe is original, and should appreciate your giving it publicity, provided you see fit. It is this:

Paper or linen treated with a plastic surface of clay substance that will not crack, peel or be affected by heat. This paper to be used with the ordinary typewriter as used for flat surface or ledger work.

The type of the typewriter striking against the clay paper would leave its impression. After the writing was completed, the sheet of "clay paper" should be removed from the typewriter, and placed in a drying oven, to free it from all moisture. The paper is then ready to receive the melted lead for the electro; the method of taking off the lead impression being the same as now commonly used in printing establishments.

The idea is to do away with the expensive and present ponderous style typesetting machine, which takes up considerable valuable space, especially in large cities. There would be no need of type and leads, with the consequent saving in the cost of same. Any stenographer ought to be able to do the work of a printer without first serving his apprenticeship. Furthermore, the clay sheets could be stored away for future use without taking up nearly the space of ordinary lead electros. Of course, the present style typewriter would require some modifications to conform with the requirements necessary. Also some device should be provided for uniform indentations, so that the electro would present a perfectly smooth type surface and insure each letter printing distinctly on paper.

I see no reason why the Rowland automatic system of telegraphy, as adopted in Germany, could not be advantageously used in this connection, whereby a newspaper reporter, at one end of the wire, might typewrite his reports, which would be received at the other end of the wire on the clay paper, and thus ready for the lead impression, and then the printing press. Where is the scientific genius who can make above ideas practicable? L. A. BONNET.

Chicago Heights, Ill., November 27, 1902.

Effect of Light on Animal and Plant Life.

To the Editor of the SCIENTIFIC AMERICAN:

In his criticism of the article of Dr. James Wier, Jr., on the effect of light on animal and plant development, Mr. E. Ritchison has fallen into a slight error. At the conclusion of his letter, after quoting a few passages from the article in question, in which the growth of sensitive plants exposed to the light under variously colored glass is discussed, he says:

"From the foregoing one gets the impression that plants under a red glass are subjected to red rays of light, while the reverse must be true, as the red glass has absorbed all the red rays of light, and the remainder only have penetrated.

"Who has not observed that in a photographic dark room, where a red light is used, anything therein which is red will appear white, for there are no red rays in the room, all being absorbed by the red paper through which the light is filtered?"

Now, in the first place, the impression that one gets from Dr. Wier's article is the correct one. Red glass or glass of any color is such, only by virtue of its property of excluding all light rays, save those of its particular color. That is to say, a piece of red glass excludes the blue and yellow rays of light and allows only the red to pass. Such a piece of glass, however, is possible only in theory, since a colored glass in practice is able to exclude only a portion of the light of a color not its own. For this reason, the experiments of Flammarion described by Wier are not absolutely questionless. The only feasible manner to secure absolute results would be to maintain the plants in the red or blue portions of the spectrum of white light.

To return to the letter of Mr. Ritchison: I have been a devotee of photography for some years, and have had a fair share of work in the darkroom, but never in my vigils over the developing tray have I beheld the peculiar appearance so nonchalantly described above. If the conditions assumed by Mr. Ritchison were true, a red object exposed to the light of a ruby lantern would appear black. A red object is one which absorbs all blue and yellow rays, reflecting those which give it its peculiar color. Exposed to a red light, a red object remains practically unchanged in its color. R. A. HELTON.

Washington, D. C.

Our New Armored Cruisers.

To the Editor of the SCIENTIFIC AMERICAN:

The recent controversy over the horse power and speed of the "Tennessee" and "Washington" appears to me to involve broader questions than I have yet seen stated. I believe that confusion has arisen through the fact that the term "armored cruiser" is now used to designate two types of vessels which have arrived at a point of definite separation and must follow diverging lines.

It is a commonplace to say that each type of naval vessel is steadily progressive. With battleships the progress is rightly directed to the guns and armor. The armored cruiser, on the other hand, has steadily increased its speed until it is to-day represented by the "Drake" with a trial speed of over 24 knots.

It is, however, possible to arrest the speed of the armored cruiser at about 22 knots and to divert the progress to guns and armor again, as the Italians have done with such success in the "Vittorio Emanuele III." This, however, produces a third type of vessel, and it will tend to a clearer understanding if we give this type the distinctive name of intermediate.

Now Rear-Admiral Melville is right when he says that the "Tennessee" and "Washington," as finally designed, are not armored cruisers. They are not the armored cruisers of to-day; that type is represented by the 24-knot "Drake." They are intermediates. They may be as fast as the armored cruisers of yesterday, but that is an incident of naval progress.

The armored cruiser is a ship in which speed is the dominant factor, and which must keep progress with the navies of the world in that regard. Its theoretical function is to "catch anything afloat," while carrying sufficient armor to fight other vessels of its own class, but not to fight battleships. The intermediate is a vessel designed to "lie in the line" in an emergency, and will soon develop into one that will do so as a matter of course. At present it is confused with the armored cruiser because its speed is about the same as that of the armored cruisers of the past; but the speed of the armored cruiser is progressive, and as soon as there are a dozen or more 24 or 25 knot armored cruisers afloat, the difference will be seen to be clear and fundamental.

The Board of Construction has decided in favor of the intermediate as against the armored cruiser, and it is not my purpose to discuss the merits of that decision. The main point is that the question is not one for the Board of Construction at all. The line of cleavage has gone deeper than a question of construction, and has separated two types. Hereafter the armored cruiser must follow the "Drake" class to a speed of 25 knots or better, while the intermediate, on a speed of fully three knots less, must follow the "Vittorio Emanuele III." to a battery of 12-inch and 8-inch guns and a side armor of 10 inches over a 4-inch protective deck. The choice between two types differing so radically in power and purpose is a fundamental question of naval strategics and should be decided by the Congressional appropriation upon the recommendation of the General Board which controls the general policy of our navy. S. M. BALLOU.

Dresden, Germany, November 14, 1902.

Troubles of Gasoline Engine Builders.

To the Editor of the SCIENTIFIC AMERICAN:

We often read of the trials of the owners of the average small two-cycle launch engines, but the builders have some troubles themselves, although they are seldom unfortunate enough to get talked about in print.

We will take, for instance, the case of Bill Woods. He finds a launch and engine complete, advertised for but one hundred and fifty dollars. Figuring that he cannot get very badly "stuck," he bites at the bait and becomes "separated from his money." When his purchase arrives, he conceals his disappointment at the absolute want of beauty in the launch's lines, knows nothing of either gasoline engines or mechanics generally, trusts to luck, and after many failures, suddenly learns that he has accomplished two important tasks. He has started the engine and simultaneously learned just how to operate gasoline engines. Vain hope! Next time he tries his skill, possibly and probably a dismal failure. Various expedients, changes in sparking mechanism and adjustments are tried, and some valuable advice even may be scornfully rejected, the chances being he has received his full quota from sympathizing friends. When he finally realizes that he has something still to learn, he has made decided progress, and unless the engine is worse built than usual, he will be able to make it run with more or less success. Next some machinist or stationary engineer tells him that those engines ought not to cost more than thirty-five dollars apiece to build, and he becomes interested, takes the machine to pieces and begins to study it. He takes the village carpenter into his secret, and soon the local papers announce that Bill Woods is building patterns for a gasoline engine on "new and improved" lines, and the village is promised a new industry, etc. Next an iron foundry, possibly whose forte is grate-bars or window-weights, is treated to a view of the embryo engine, when his trials then begin in earnest. Patterns won't draw, core boxes are wrong, cores will not fit the prints; these being remedied, "cold shucks," sand and blowholes appearing, the foundryman gives it up, Bill gathers his patterns together and "steals away" to some other foundry. Perhaps here they may have done similar work, know his requirements, make necessary changes and get out some fairly satisfactory castings. Next he buys a second-hand drill press, lathe, and shaper and is fully equipped to "manufacture." After several apparently unsurmountable obstacles have been overcome, his engine is built and set up for a shop trial. The cylinder is probably not quite true, piston rings may not quite fit, and the head may be dished just enough to let water from the jacket into the cylinder; shaft may not be exactly in line, and ten to one his wristpin is not parallel with crankpin. Clearance is probably too little and, owing to leaky rings and piston when explosion takes place it has very little power, and should he be fortunate enough to get it to run at all, he has to be extremely careful not to rub his foot on the flywheel or he will stop it. Then he begins to realize that a gas engine to run well must be carefully made as well as cheaply, and he rebores cylinder, makes new piston and rings and is able to get more satisfactory results, while the papers begin to get a little sarcastic and facetious in their gas engine items. He places this new piece of wonderful mechanism in his boat, and at its first trial finds the old engine gave him more speed. Several times he starts out, and ignominiously rows or is towed back by some kind-hearted sympathizer. At last he makes a run to some objective point, usually with favoring tide, tries to return with same tidal help, and cheerfully lies about the elapsed time and speed. How his bump of importance develops!

Well, he has built his first successful (?) engine; and soliciting orders he begins what he calls their manufacture, but finds his original estimate of cost too low, except that of a great deal of expensive machinery and tools he purchased, to make interchangeable parts by gage. His facilities are limited, and he does the best he can. Some engines run and some do not. His stock of "slightly used engines taken in exchange for larger sizes" steadily increases. His methods of lubrication and insulation are most defective, and if he is able to sell any engines, they constantly give out and new parts or repairs are demanded. His technical and theoretical knowledge of construction is *nil*, while his practical experience is but little more. Still he goes on bluffing it out, always in hopes of better things.

The larger sizes bother him more than the small, and when he so far forgets himself as to attempt putting two cylinders on one base his "cup runneth over." While he could at least get along very comfortably with one, he finds two cylinders are several times too many. Come to think of it, how many satisfactory two-cylinder two-cycle engines did you ever see in operation? Ten chances to one the double-cylinder engine never leaves the shop. Better for him that it does not.

These troubles which beset the scores of small launch motor builders are not unknown to many of our larger manufacturers, with well-equipped, well-found shops, capable mechanics in charge and up-to-date methods in vogue.

The whole matter summed up is this: Almost any one can build a gas engine, but he cannot always make it run, and while we offer, free as the air we breathe, advice to owners, let us reserve some small portion for the builders of these inferior productions, unfortunately often selected in preference to the good article.

Bridgeport, Conn. A. E. POTTER.

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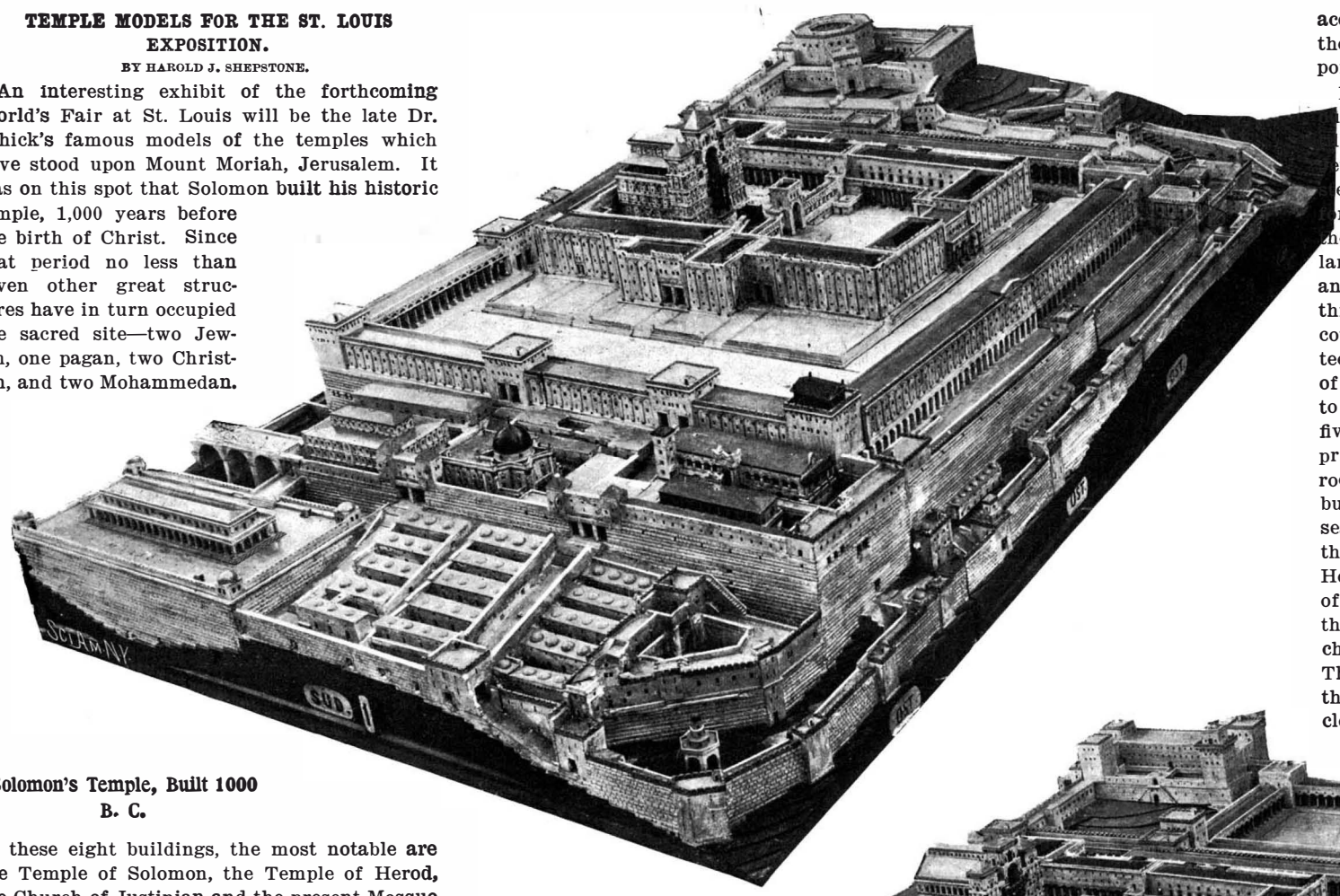
TEMPLE MODELS FOR THE ST. LOUIS EXPOSITION.

BY HAROLD J. SHEPSTONE.

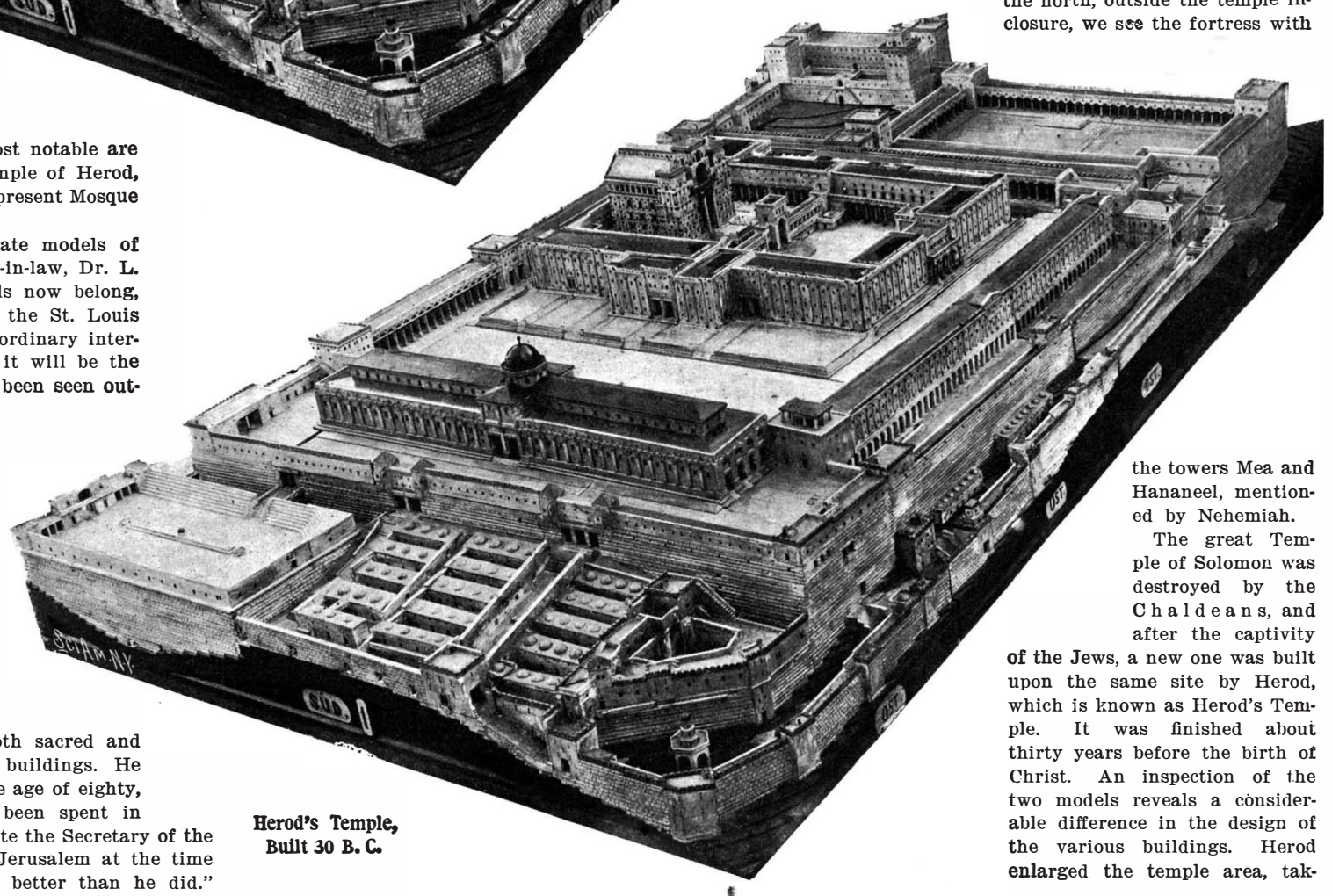
An interesting exhibit of the forthcoming World's Fair at St. Louis will be the late Dr. Schick's famous models of the temples which have stood upon Mount Moriah, Jerusalem. It was on this spot that Solomon built his historic temple, 1,000 years before the birth of Christ. Since that period no less than seven other great structures have in turn occupied the sacred site—two Jewish, one pagan, two Christian, and two Mohammedan.



Solomon's Temple, Built 1000 B. C.

Of these eight buildings, the most notable are the Temple of Solomon, the Temple of Herod, the Church of Justinian and the present Mosque of Omar.

Dr. Schick made very elaborate models of these four temples, and his son-in-law, Dr. L. Schoenecke, to whom the models now belong, has decided to exhibit them at the St. Louis Exhibition of 1904. More than ordinary interest attaches to this exhibit, as it will be the first time the models have ever been seen outside of Jerusalem. Previous efforts to secure them for exhibition purposes have always failed. As already stated, they represent the work of the late Dr. Schick, a well-known German archæologist, who gave thirty-two years' patient study to the buildings which have occupied this particular spot during the last 3,000 years. He made a very exhaustive study of the locality itself, as well as of all literature, both sacred and profane, dealing with the ancient buildings. He died on December 23, 1901, at the age of eighty, fifty years of his life having been spent in Jerusalem. "No one living," wrote the Secretary of the Palestine Exploration Fund at Jerusalem at the time of his death, "knew Jerusalem better than he did." He was honored by several learned societies, and was much sought after by scholars and others interested in the archæology of Palestine.



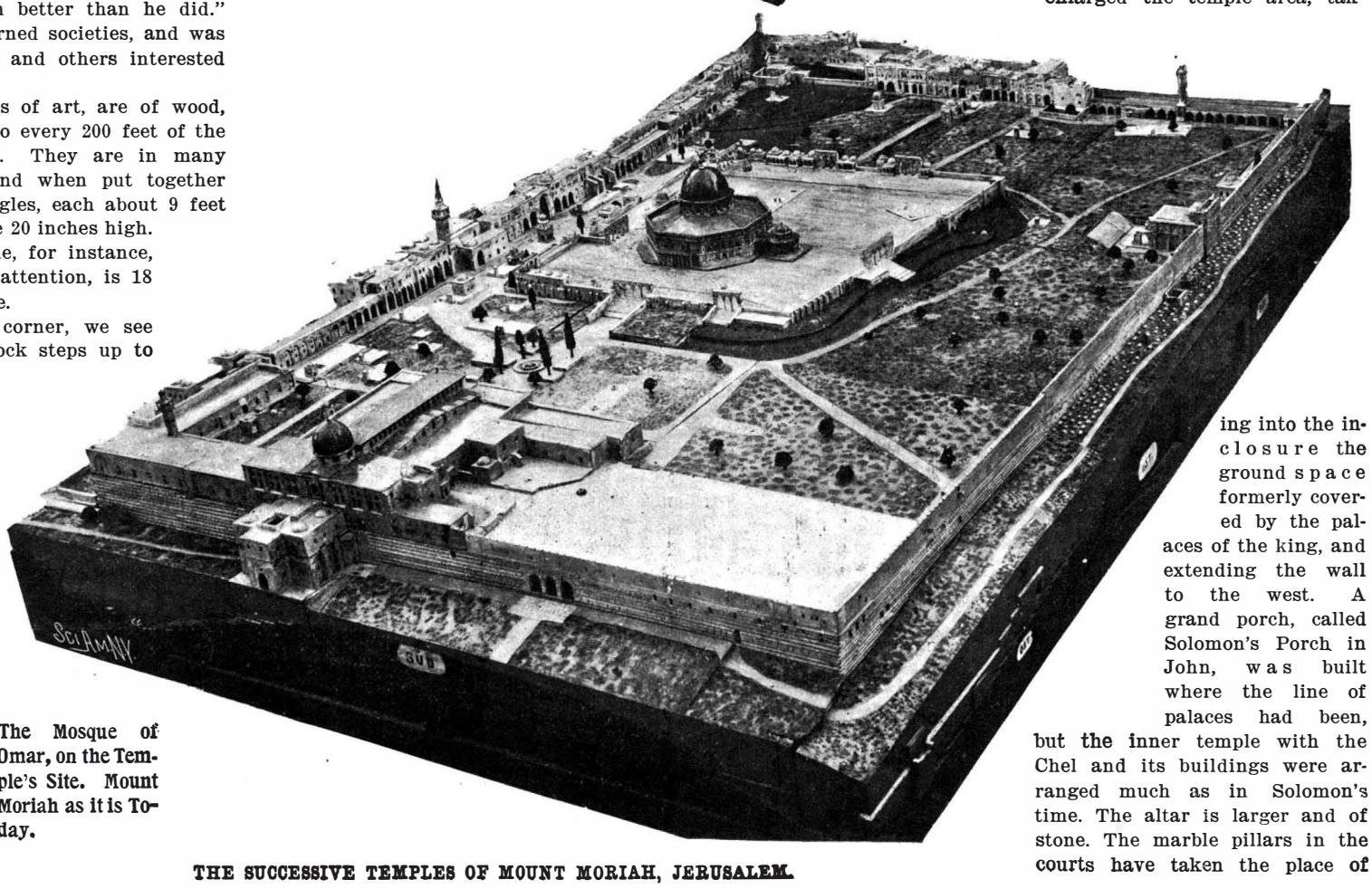
Herod's Temple, Built 30 B. C.

The models, which are works of art, are of wood, and made to a scale of 1 foot to every 200 feet of the entire plateau, or temple site. They are in many pieces to facilitate removal, and when put together each model forms two quadrangles, each about 9 feet long and 5½ feet wide, and some 20 inches high. The model of Solomon's Temple, for instance, which naturally attracts prior attention, is 18 feet long and nearly 6 feet wide.

Beginning at the southeast corner, we see part of the mount rising in rock steps up to the city wall, the valley of Kedron to the right, and the Tyropœan valley to the left, and inside, the wall of the mills bastion and the "house mills." Following up are two streets leading to the double and triple gates of the "king's house." On a higher terrace is the palace of the king, Solomon. Here to the left is the "house of the forest of Lebanon," and crossing above the double passage, we reach the judgment hall, in which was the throne of the king, and, further, after crossing the triple passage, the king's private lodging. Above this terrace of palaces and on a higher level are the outer temple walls and porches forming a great square.

Inside the porches extends the ...ter court, or court of the Gen...les, behind which none but ...ews could go. A rise of twelve ...eps brings us to another plat...rm or terrace called Chel, or ...he Rampart, on which stands a large building with three wings and three stories high. Inside this building are the middle court and the inner court. Fifteen steps, on which the Psalm of Degrees was chanted, led up to this inner court, and thence up five steps to the court of the priests, and there, on the holy rock of Sakhra, stood the altar of burnt offerings and the brazen sea. Up twelve steps more, on the highest platform, stood the House of the Lord, where the ark of the Covenant reposed, beneath the outspread wings of the cherubim in the holy of holies. The house faces to the east. On the north, outside the temple inclosure, we see the fortress with the towers Mea and Hananeel, mentioned by Nehemiah.

The great Temple of Solomon was destroyed by the Chaldeans, and after the captivity of the Jews, a new one was built upon the same site by Herod, which is known as Herod's Temple. It was finished about thirty years before the birth of Christ. An inspection of the two models reveals a considerable difference in the design of the various buildings. Herod enlarged the temple area, taking into the inclosure the ground space formerly covered by the palaces of the king, and extending the wall to the west. A grand porch, called Solomon's Porch in John, was built where the line of palaces had been, but the inner temple with the Chel and its buildings were arranged much as in Solomon's time. The altar is larger and of stone. The marble pillars in the courts have taken the place of



The Mosque of Omar, on the Temple's Site. Mount Moriah as it is Today.

THE SUCCESSIVE TEMPLES OF MOUNT MORIAH, JERUSALEM.

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pillars of brass. The upper room has a greater roof, and the middle tower of the front is unfinished. Herod's fortress, Antonia, has taken the place of the old strong place on the northwest. This temple was destroyed by the Romans.

Equally interesting is the model of the great Christian Church of St. Mary, built in the reign of the Emperor Justinian and known as Justinian's Church. A detailed description of the model is unnecessary here. Dr. Schick was of the opinion that it was erected on the foundations of the temple of Jupiter, built in the second century by Hadrian. The fourth model, Haram Es-Cherif, shows Mount Moriah, the site on which the preceding temples have been built, as it is to-day. It will be seen that a beautiful mosque has taken the place of Justinian's church. The first building within the inclosure is the Aksa mosque, and close to it the mosque for the women, once the armory of the Knights Templars. The great mosque shows traces in its architecture of all the phases of ownership it has seen—Byzantine, Crusader, and Saracen.

As could only be expected, the models have caused a great deal of discussion in archæological circles. It is impossible to know in certain instances the exact architecture of the buildings, but all are agreed that Dr. Schick's models represent with marvelous ingenuity and faithfulness the great and ancient worshiping places that have stood upon the famous temple site at Jerusalem. They undoubtedly show great intelligence, patient industry, and profound scholarship. Dr. Schoenecke, the present owner of the models, is always pleased to show them to visitors to Jerusalem, and many Americans have expressed interest in them.

London, S. W.

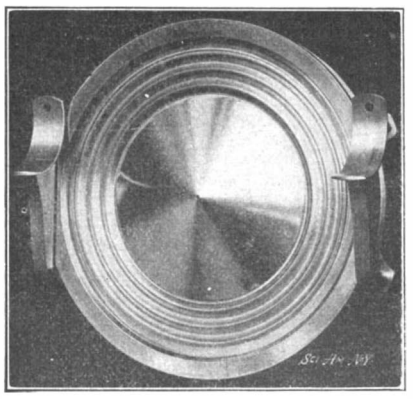
A "SCIENTIFIC" VIOLIN.

BY H. C. FYFE.

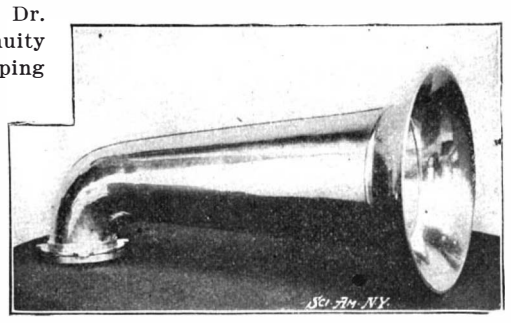
Mr. Augustus Stroh, a well-known London man of science and inventor, has lately brought out an entirely new kind of violin, of which some photographs are given on this page. On looking at the instrument, the first thing that strikes one is the fact that there is no sounding box, and that instead of this feature of the violin, hitherto considered indispensable, there is a metal trumpet or resonator and a diaphragm also composed of a metal substance. Mr. Stroh's object was to turn out a violin which should equal in quality of tone the fine old instruments of the classic makers and should be in every respect as beautiful an instrument, so far as sound was concerned, as the fiddles of Amati or Stradivarius.

The ordinary, common form of violin consists, as everybody knows, of the strings, the bridge and the sounding box or body. It was thought that all string instruments must have a sounding box, which would be set in sympathetic vibration with the strings of resonance if any considerable effect was to be attained, and the maker of violins showed his skill by the manner in which he made his sounding box. The body required special wood, special varnish, etc., and in the construction of violins the great Cremona makers have for long held first place.

The violinist had to pay a high price for one of their instruments, but he knew that it could not be equaled by any other modern maker. Mr. Stroh having given much attention to musical instruments, decided to abolish the "body" or sounding box of the violin and to substitute for it a trumpet or resonator made of aluminium. The following description, together with the photographs here reproduced, will give a good idea of the construction of the Stroh violin. The vibrations of the strings are conducted by means of an ordinary violin bridge, which rests upon a rocking lever, to a diaphragm and resonator. The lever supporting the bridge oscillates laterally upon the body of the instrument, each being attached to a diaphragm of aluminium by a small connecting link. The diaphragm is held in position between two india rubber cushions by means of a specially designed holder fixed upon the body of the violin by two brackets.

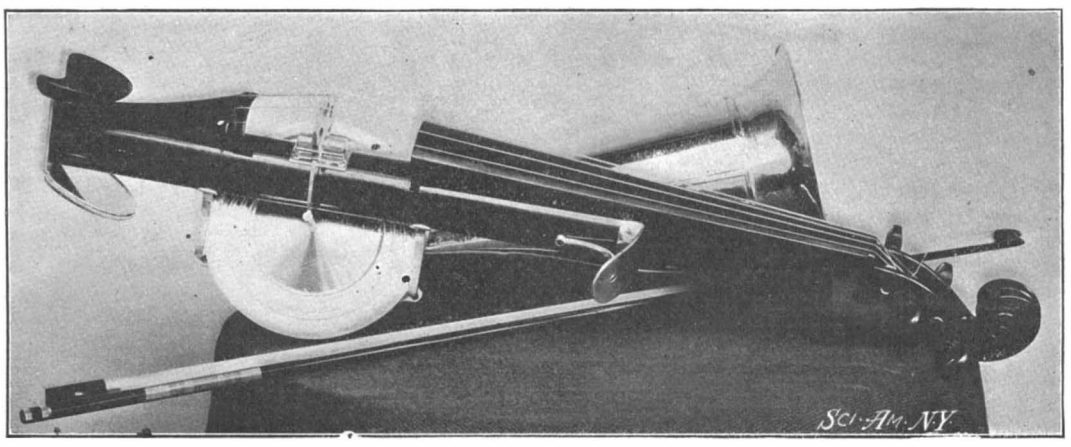


The Vibrating Diaphragm in Holder.



The Resonator or Trumpet.

Lever and Rocking Bridge.



THE STROH VIOLIN.

Attached to this holder is the trumpet or resonator. The body or main support of the instrument is in no way employed for sound purposes; it simply holds the various parts of the violin together and sustains the enormous tension of the strings when tuned. The disk or diaphragm which represents the belly of an ordinary violin, is perfectly free to vibrate, the result being that when the strings are set in motion by the bow, the bridge and rocking lever vibrate accordingly, and thus every vibration is transmitted to the diaphragm.

The diaphragm sets in motion the air contained in the resonator, the resonator augmenting and distributing the sound to the surrounding atmosphere.

London, England.

A Japanese Opinion of American Patents.

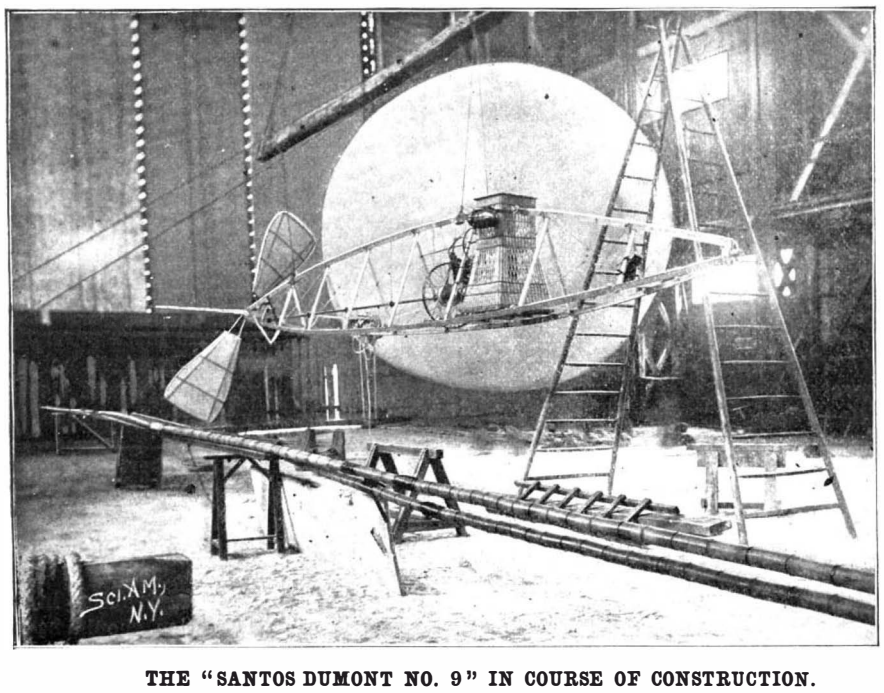
Some three years ago the Japanese government sent to this country a certain Mr. Takahashi to study our patent system. Mr. Takahashi pays a glowing and picturesque tribute to the American system. "We saw the United States not much more than one hundred years old," he said, "and we asked, 'What is it that makes the United States such a great nation?' We investigated, and found it was patents, and so we will have patents."

THE "SANTOS-DUMONT NO. 9."

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The new airship which Santos-Dumont is constructing at Paris will be the smallest that has yet been made. It is being built at the Lachambre aerostatic park, and is nearly finished, as will be noticed in the different views of the car and balloon. The latter has somewhat the form of an egg, with the large end placed foremost. Its length is about three times the diameter. The aeronaut is experimenting with this form of balloon, which differs considerably from its predecessors. The ovoid form will no doubt prove more stable than the cigar-shaped, and will give less pitching, although of course as high a speed cannot be attained with it. Only the light weight of the aeronaut, 110 pounds, permits of constructing such a small airship. The balloon is constructed of Japan silk and has a capacity of only 280 cubic yards. An upper valve is not made use of, but a tearing cord is employed instead, while below, in the rear, is a valve opened by a cord from the car. The balloon is provided with an interior air bag of 58 cubic yards capacity; this will be kept filled out by a ventilating fan. The total length of the balloon is but 45 feet, and its diameter, in the largest part, 18 feet. The balloon is to advance with the large end foremost, like the balloon "La France" with which the Renard brothers made their celebrated experiments in 1884. The photographs were taken while the balloon was being inflated with illuminating gas in order to fill it out in shape and allow the wires to be attached. On each side of the balloon a piece of fabric is firmly fastened to the canvas. To the eyelets of these strips will be attached, by connecting pieces, a series of steel piano wires which support the car. There will be 40 of these wires, and they have been carefully tested. Each wire, with a diameter of .032 inch, can support a weight of 190 pounds.

The framework or car is constructed on somewhat the same lines as before, and is suspended 7 feet below the balloon. It is quite small, and measures but 29 feet long and 3 feet high in the center. The framework, of pine, is made up of three main pieces of triangular section, bent into an arc of a circle, and braced



THE "SANTOS DUMONT NO. 9" IN COURSE OF CONSTRUCTION.

THE CAR OF THE "SANTOS-DUMONT NO. 9."

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in seven places by three light strips forming a triangle. In the rear is the propeller, which is made of steel tubes, flattened out at the extremities, and covered with varnished silk to form the blades. The propeller is 10 feet in total diameter and weighs 24 pounds. Each blade is 4.5 feet long and its greatest width is 15 inches. The photograph shows the position of the aeronaut's car, which is suspended toward the front. In the rear of the car is mounted the motor, which is a light-weight gasoline one made by the Clement Company. It is extremely small and light, weighing but 26.4 pounds, yet developing 3 horse power. The weight per horse power is thus only 8.8 pounds. The motor is of the double cylinder, air-cooled type, the cylinders being set at an angle on to a light crank-case box of aluminium. The flywheel, which will be noticed next the motor, is made of a simple bicycle wheel, and weighs but 1.8 pounds. The motor is thrown in or out of gear with the main propeller shaft by an aluminium friction clutch, mounted in front of the flywheel. The clutch is held in normally by a spring, and is thrown out by a lever within easy reach of the aeronaut. The car, of basket work, has the well-known form adopted by Santos-Dumont, and is just large enough to allow the aeronaut's body to pass, although it widens somewhat at the lower part. It is but 16 inches square and 36 high, and weighs 12 pounds. It is braced at the top by a metal tube, which passes around it and joins the main beam. At the side of the car will be noticed the gasoline tank, which is pointed at the ends and contains 2.5 gallons. From the motor the shaft passes back to the propeller, and revolves in four light bearings, which are supported from the frame by piano-wires. Near the propeller the frame carries a cross-bar, which receives the ends of the supporting wires, to prevent their becoming entangled in the screw. The total weight of the framework, including the motor, shaft, propeller, and basket car, is 132 pounds, and the balloon weighs 30 pounds, thus giving the complete airship less than 200 pounds total weight. The car will be provided with a hemp trail-rope 100 feet long. The propeller turns at 200 revolutions per minute. The speed of the airship will probably not reach over 16 feet a second. The aeronaut has been making a series of tests of the motor and propeller. The propulsive effort of the latter was measured by a dynamometer, and was found to be as high as 65 pounds. The motor runs easily, and the mechanism appears to be quite satisfactory. Santos-Dumont is pleased with the results, and is confident that the airship will be easily handled. After the balloon, which is now inflated with illuminating gas, is attached to the car, it will be refilled with pure hydrogen from the generator located on the grounds; and within a short time it will be ready for the trial ascensions. Santos-Dumont intends to make the trip from the aerostatic park across Paris, and to land at the window of his second story apartment on the Champs Elysées. For this purpose he will construct a special balcony outside the window, composed of light copper tubes.

After making the trials of the small balloon ("No. 9"), he will be ready to commence "No. 10," which is to be eight times the size of the present one and capable of carrying ten persons. Before building such a large airship, he thought it more prudent to make a series of experiments with a balloon of the same type but of much smaller size; and it is for this purpose that he constructed the small one we illustrate. The "Santos-Dumont No. 9," and the large airship "No. 10," will differ considerably from the former types. Up to the present, he has used the cigar shape; but now he wishes to find out whether the ovoid form has not some advantages, at least where high speed is not the main factor.

The Nobel Prizes.

The report published in the SCIENTIFIC AMERICAN concerning the award of the Nobel prizes now receives official confirmation. The honors in physics were divided by Dr. H. A. Lorentz and Dr. P. Zeeman, both of Holland. The chemical prize was taken by Dr. Emil Fischer, of Berlin. The medical prize was received by Major Ronald Ross, principal of the Liverpool School of Tropical Medicine. The venerable historian Theodor Mommsen received the literary prize.

To American readers some of these men may not be well known. Zeeman is the man who discovered that if a beam of light were passed through a magnetic field before being analyzed by a spectroscope, the lines in the spectrum would be doubled. Lorentz worked on kindred subjects—the theory of radiation and the relations of the ether to matter. It is singular that both of these men are Dutchmen, countrymen of the famous Van t'Hoff, who received the prize in chemistry last year.

Fischer is a most versatile scientist. His early work was in the field of coal tar. More recently he has studied the amino and diamino acids, which are products of the decomposition of proteids.

To Major Ross is principally due the theory that the mosquito is an active agent in the dissemination of malaria. Laveran has discovered the parasite in the blood of its human victims. Major Ross proved that the mosquito had much to do with conveying the germ from one person to another.

THE EGYPTIAN PAINT PALETTES

BY WALTER L. BEASLEY.

Among the noteworthy and curious finds which have recently been brought to light from Egyptian excavations are the series of carved slate palettes found at Hierakonpolis, by Prof. Petrie, in the great tomb of the first pre-dynastic kings, who reigned 5,000 to 6,000 B. C. These long-buried fragments vividly portray the art practice of this remote period. The palettes are considered to be among the most important of early monuments and of great interest zoologically, as showing several animals now extinct in Egypt. The palettes were employed by the royal ladies for grinding the face-paint, and the cup-hollow or ring-space on each was for holding the paint. The sculptures on the slates are supposed to refer to battles and victories before or at the establishment of the united monarchy under King Menes, and the conquered were the different natives—negroes, Libyans inhabiting that country before the coming of the first dynastic Egyptians. That the race who made these monuments had high artistic tastes and a knowledge of technique that argues a long practice of art is apparent from the objects themselves, which are eminently superior to any later Egyptian work.

THE NARMAR PALETTE.

Two typical examples of the slate palettes are here pictured. One has been identified from inscriptions as belonging to King Narmar, whose reign is now fixed by his tomb as being just before Mena. At the top are two heads, supposed to be the goddess Hathor. In the next division the first figure is a personage bearing a pair of sandals, having in his right hand a vase. He has short hair, covered by a close-fitting cap. Before him is seen the King, wearing the crown of Lower Egypt, dressed in a tunic arranged over the shoulders so as to leave the right arm and shoulder bare. He carries in his right hand a mace, and is preceded by his queen, with curled locks, clad in a tight-fitting garment. In front of her are borne by attendants four standards having the emblems of Horus. The bearers are depicted with short hair and close-fitting caps, wearing greaves. The right space is taken up apparently with a sacrificial scene. The corpses of ten bodies are seen in two rows, their arms bound, and heads cut off lying between their feet. All of the victims are bearded and wear caps with a double peak. The center division shows two composite monsters, having the bodies and heads of lions or panthers, with long intertwined necks. They are tied with cords around the neck, held by two men. The hollow space made by the curl of the two necks is used for the deposit of paint. The lower division represents the King in the shape of a bull, trampling upon a flying enemy, probably the Libyans.

EGYPTIAN SLATE PALETTE.

The broken slate pictures a race of bearded warriors, evidently engaged in hunting. The majority are armed with bows and arrows having flint heads and feathered on both sides of the shaft. Some carry long spears, javelins, double-headed axes, and a weapon on the style of a boomerang. Two have lassoos. At the extreme left is a lion pierced by six arrows, and at the right another with two. Close to the edge of the right foreground is drawn a building with a cupola, near which is a strange monster, consisting of the forepart of two bulls joined together about the middle of the body. In the middle the animals are depicted as running, being pursued by a greyhound. The animals represented are hartbeests, one of which has been lassooed, an ostrich, stag, two jackals and a gazelle. A peculiar feature observed on the originals was that the eyes of all the animals had been bored out, evidently with a drill, and inlaid with some substance like glass. Prof. Petrie states that at this early period ordinary daily objects were developed into ceremonial show-pieces and made the vehicle for historical records.

Government Aid for the Russian Merchant Marine.

A spirited effort was made by the Russian government last year to encourage the construction of merchant vessels and to stimulate Russian navigation by the formation of a special commission under the presidency of the Grand Duke Alexander Mikhailovitch to investigate the subject. This commission elaborated a scheme providing as follows: The grant to shipowners of loans, without interest, amounting to half the cost of construction of ships owned and built of Russian material in Russia; repayment is to be spread over twenty years in equal installments, the vessels to be mortgaged for the amount due during that period. Insurance premiums on ships to two-thirds of their value to be paid by the government, the shipowner paying two per cent per annum on the amount, while the remaining third of the value may be insured by the owner when he pleases. To encourage the export of Russian goods in vessels of Russian construction the government will repay half of the cost of the fuel consumed in working the engines, provided such fuel is of Russian origin; the vessel claiming this privilege must load cargo at a Russian port for abroad to the extent of three-fourths of its carrying capacity. All these privileges will be granted exclusively to shipowners of Russian nationality and to associations of which all the members are Russians, and they are to come into force from January 1, 1903.

Experiences in a Submarine.

Lieut. Lawrence Spear, formerly naval constructor, who recently read a paper in New York on submarine war vessels before the Society of Naval Architects and Marine Engineers, gave to a representative of the Tribune an interesting description of his experience while under water during a three hours' trial of the "Adder" in Peconic Bay.

Fifteen miles were traveled under water without coming to the surface once. After the first hour the trip became monotonous. There were eleven men in the boat, nearly 18 feet below the surface of the water. No noise could be heard except that of an electric motor driving the boat through the water at 7 knots. The captain stood with his head in the conning tower, steering by the little compass and timing the boat by his watch, so that he might know when to turn her around and begin the return trip of the three-mile course. Water could be seen rushing by, but nothing else could be distinguished except the small brass whistle which stands close to the rear of the tower; the rest was just a wall of green water through which the "Adder" was rushing. Objects ten feet away could not be seen. As for the air, it was as pure as any could be in a room of the same area, and much purer than that of many a card-room in which men sit, not for three hours, but for ten and twelve hours with closed doors, and with the air vitiated by tobacco smoke.

To Our Subscribers.

With the next issue many subscriptions to the SCIENTIFIC AMERICAN will expire. It may not, therefore, be amiss to call attention to the fact that unless subscriptions be renewed, the paper will be discontinued. In order to avoid any interruption in the sending of the paper, the subscription should be remitted before the new year.

During the past year the SCIENTIFIC AMERICAN has more than ever maintained its standard of excellence. The Special Numbers which have been issued have attracted the widest possible attention. The Transportation Number, for example, issued last week, has been most flatteringly commented upon by many subscribers, as well as by the daily press.

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Patent Department

Automatic Telegraphy.

Among all the problems which engage the attention of inventors there seems to be none more attractive than that of combining telegraphy and typewriter in such a manner as to produce a high-speed instrument saving time and labor at the wire. Automatic senders and receivers of one kind or another are submitted to the Western Union at the rate of about one a week and rejected at the same rate.

There is a fortune in store for the man who can invent a high-speed sending and automatic receiving instrument, says The New York Sun, but there is one tremendous obstacle in the way of inventors who attempt it. That obstacle is the limit to the capacity of the operator of the typewriter.

It is comparatively easy to invent a combination of typewriting machine and telegraph instrument in which the operator, when he pounds the keyboard at one end of the wire, records, after the manner of the stock ticker, line by line on ordinary paper at the other end of the wire the words he frames at his end. The trouble is that he cannot do it fast enough.

The operator who in practice can typewrite 100 words a minute has yet to be found. The speed at which the wire can carry the message is almost limitless. At present it is limited only by the capacity of the operators, sender and receiver, and speed, even more than labor-saving, is the thing the telegraph companies are seeking.

For the last three years the Western Union has been experimenting on two circuits between New York and Chicago and New York and Buffalo with an automatic system called the Buckingham. This is not strictly a combination of telegraph and typewriter.

The typewriter is a perforating instrument which punches holes in sheets of paper which are fed into the sending instrument and are sent and received automatically. By this system from fifty to sixty messages of an average of thirty words each can be sent an hour. The trouble about this is that two or three men are required to prepare the messages.

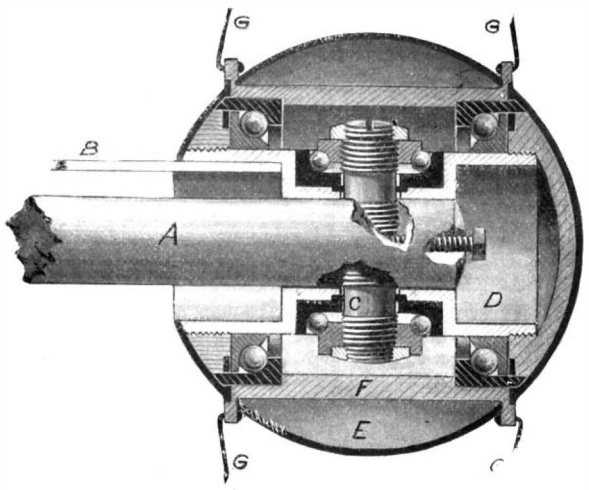
There is an instrument already invented and now being perfected and developed for commercial use which may be brought into practical use before automatic telegraphy comes to pass. This is the Poulson telephonograph, invented by a Dane.

In this instrument words spoken into a phonograph combined with a telephone are reproduced on patent tape at the other end of the wire. Should this be developed cheaply and universally it may revolutionize telegraphy.

PIVOTED HUB.

The accompanying illustration shows an improved pivoted hub which is more especially designed for the front or steering wheel of a road vehicle, to permit the convenient and quick turning of the wheel in the desired direction. The construction is such as to reduce the friction of the working parts to a minimum, and the various details are so arranged as to facilitate adjustment, permit proper lubrication and render the device entirely dust-proof.

The wheel, which is mounted on axle *A*, is steered

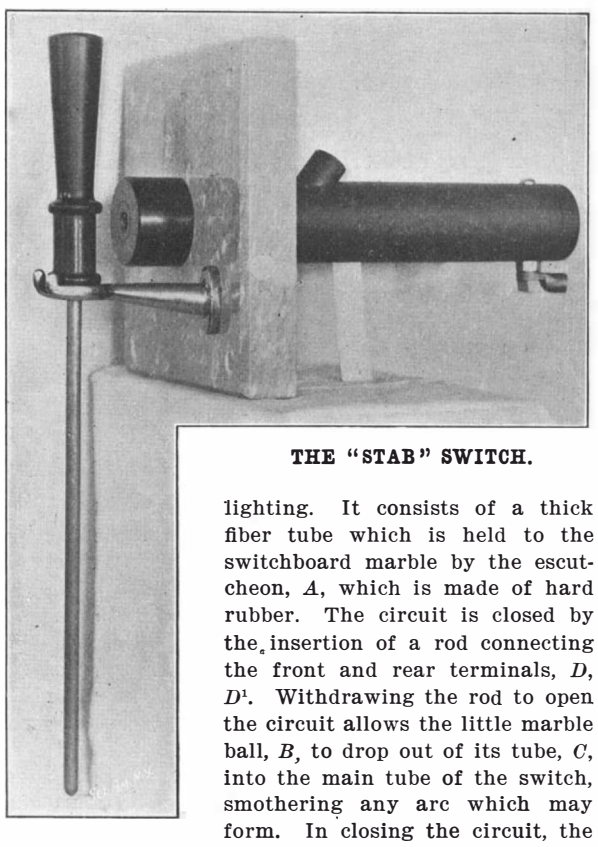


PIVOTED HUB.

by a bar *B* secured to the inside of the bearing *D*. A vertically-disposed pivot *C* passes through this bearing and the axle, and is held firmly in place by a set screw. A cone is screwed on each end of the pivot piece, engaging balls mounted in a cup fitted in a recess of the tubular bearing *D*. Ball bearings are also mounted near the ends of the tubular bearing to support the hub *F*. A spherical covering plate *E* fits over this hub between the annular flanges to which the spokes *G* of the wheel are secured. Suitable packing rings are provided at the bearings to prevent the entrance of dust, and lubricants are admitted through a pipe in the hub. The inventor of this device is Mr. J. H. Genter, 25 Second Avenue, Albany, N. Y.

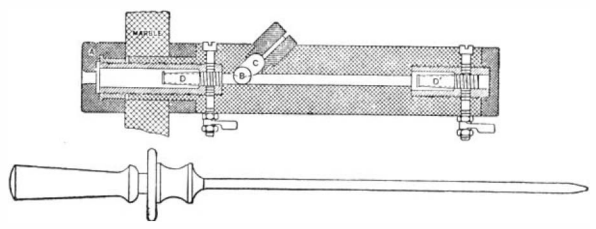
THE "STAB" SWITCH.

A new form of electrical switch is shown in the accompanying pictures. It is known as the "Stab" switch, and while its exceedingly neat appearance is one of its strong features, it is said to be of great efficiency, being designed particularly for series arc and incandescent



THE "STAB" SWITCH.

lighting. It consists of a thick fiber tube which is held to the switchboard marble by the escutcheon, *A*, which is made of hard rubber. The circuit is closed by the insertion of a rod connecting the front and rear terminals, *D*, D^1. Withdrawing the rod to open the circuit allows the little marble ball, *B*, to drop out of its tube, *C*, into the main tube of the switch, smothering any arc which may form. In closing the circuit, the



SECTION OF THE "STAB" SWITCH.

rod, which is pointed, pushes the marble ball up into the tube, *C*. It is claimed that this switch works satisfactorily up to 6,000 volts, and it is readily removed from the marble by simply unscrewing the escutcheon.

Franklin Institute Prizes for Inventors.

The Franklin Institute of Philadelphia has from time to time received endowments for the purpose of enabling its Committee on Science and Arts to recognize in a fitting manner noteworthy contrivances of American inventors. The Institute issues diplomas of merit to applicants in cases where awards of medals have been made to inventors, and where the applicants have failed to receive recognition for their share in the development of an invention. In order further to increase the value of awards as well as to give greater publicity to the work of the Committee on Science and the Arts, each award or recommendation is accompanied by an engraved certificate of the fact.

In the month of May, 1890, Edward Longstreth, machinist and retired member of the Baldwin Locomotive Works, deposited with the Franklin Institute the sum of $1,000 for the founding and perpetuation of the Edward Longstreth silver medal. The interest accruing from the principal of the sum is used in awarding the medals for encouragement of invention, and in recognition of meritorious work in science and the industrial arts. The awards are made by the Franklin Institute through its Committee on Science and the Arts.

Mr. Longstreth also presented to the Institute twelve silver medals and their dies. These Longstreth medals are awarded for useful inventions, important discoveries, and meritorious work in contributions to science or the industrial arts.

Mr. John Scott, an Edinburgh chemist, in 1816 bequeathed the sum of $4,000 to the corporation of the city of Philadelphia, directing that the interest and dividend on that sum be laid out in premiums to be distributed among ingenious men and women who make useful inventions. Each premium of $20 is accompanied by a copper medal bearing the inscription "To the most deserving." These awards were later vested in the Franklin Institute. The rules for the John Scott legacy premium and medal can be obtained from the Institute.

In 1848 Elliott Cresson, of Philadelphia, conveyed to the Franklin Institute the sum of $1,000. Out of the first sufficient moneys received for interest on this sum, suitable dies were to be prepared for striking a gold medal. After the dies had been prepared, the Trustees were to have gold medals made, which the Treasurer of the Franklin Institute was to deliver to such persons as had made meritorious discoveries in the arts or sciences or who had invented or improved some useful machine or had devised some new process or combination of materials in manufactures, or had shown ingenuity, skill or perfection in workmanship.

The Origin of the Omnibus.

No less a personage than the famous mathematician, Blaise Pascal, is said to have introduced the important vehicle, which we call the "omnibus." Unlike most other men of learning, Pascal was more or less interested in the affairs of practical life. He was the inventor of the push-cart that now perambulates our streets.

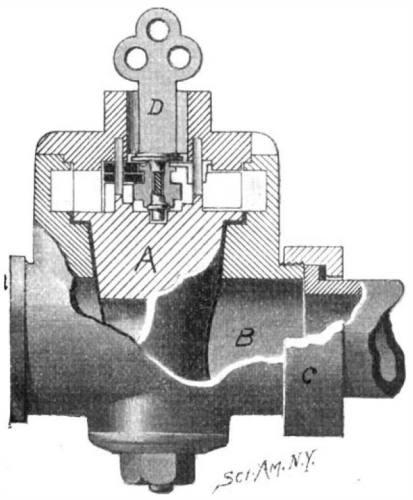
In 1661 he had large wagons built for regular traffic in the heart of Paris. He allied himself in this undertaking with several influential friends, among whom was the Duke de Roannes.

In 1662 Louis XIV. granted letters patent to Pascal, in which it was said that these carriages were intended for the comfort of poor people who had to go to courts of justice, or who were sick and so poor that they could not afford to pay the two pistoles exacted by the chairmen and the drivers of coaches. At first the use of the vehicle was not generally permitted. A royal decree forbade its use by soldiers, pages, lackeys, and other liveried servants, as well as artisans and porters.

Pascal, in spite of the fact that he only lived to be thirty-nine, is said to have made no inconsiderable sum out of his invention. After the vehicle had been in use for some sixteen years, it was abandoned for various reasons. It was not until 1812 that it was again introduced, this time in Bordeaux, which city was followed in 1821 by Nantes and in 1827 by Paris. The vehicle was improved and rapidly became popular. Now it has been almost displaced by the tramway. In modern times the vehicle was called an omnibus simply for the reason that it was intended for the carriage of all, without any restrictions as to lackeys, pages, or footmen.

LOCK VALVE.

For the purpose of preventing dishonest persons from using water or gas without the same having passed through the meter, Mr. William H. Baker, of 156 Waverley Place, New York city, has designed a valve which may be operated by the use of a key only. The valve plug *A*, as shown in our illustration, which is provided with the usual central opening for the passage of fluids, fits snugly into the valve-casing *B*. The lower end of the plug is turned down and threaded to engage a nut which securely holds the plug in place. A cap-piece fits over the upper end of the plug in a socket in the valve casing. The under surface of this cap-piece is provided with a suitable lock having bolts, which may be operated to enter recesses in the side walls of the valve casing. The lock is operated by the key *D*. The key passes into the lock between projecting walls on the cap-piece which form an angular nut. When the bolts have been withdrawn from the recesses in the valve casing, this nut may be



LOCK VALVE.

gripped by a wrench and the cap-piece rotated. The valve plug is provided with posts which enter sockets in the cap-piece, so that rotation of the cap-piece results in the opening or closing of the valve. The lock shown comprises a key-post and a number of independent tumblers; furthermore, the lock is double-acting, in that it has two bolts sliding in opposite directions, the bolts being to some extent independent, so that it would be extremely difficult to open the lock without the use of the proper key.

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Brief Notes Concerning Patents.

Henry Finne, Norwegian of Stavanger, has invented a machine which has marvelous capacity for making the boxes in which sardines and anchovies are packed. Hitherto a skilled laborer could make about six hundred tins per day, but by the use of this machine about eighteen thousand can be turned out with the same labor.

Since the beginning of the coal strike, there has been a great activity among the inventors of various apparatus designed to utilize oil as fuel. There has been a weekly average of twenty-five applications for inventions of this character. The total number of patents granted for these devices to the first of September was 3,980. Of this number, 1,280 provided for the burning of the oil directly, and the others made use of the vapors. These two divisions represent the basic ideas at the root of all devices for making use of oil for fuel.

Oscar P. Ostergren, a Swede who figured largely a few years ago as inventor of a number of appliances for the manufacture of liquid air, on which one of the leading companies endeavored to operate, is reported to be violently insane and has been placed in the Bellevue Hospital in New York. The company with which he was identified, equipped a place in New York and did engage in the manufacture of liquid air in a small way, but before it could get seriously at work the members of the company became engaged in dissensions. Ostergren was the designer of an oil engine which is in general use.

A scheme to establish a home for indigent inventors is being actively agitated by J. Dana Bickford, who himself is a well-known inventor. The project has received a great impetus already in the promise of a site for the institution. This consists of a fine old mansion at West Medford, Mass., which has a valuation of about $20,000, and with this as a start, an effort is about to be made to interest a number of the more prominent persons in this line of work, with a view of securing subscriptions. It is said that Mr. Edison has lent his name to the furtherance of the project, as well as a number of others equally prominent.

Mr. C. T. Blacklidge, of the United States Coast and Geodetic Survey, has patented a new style of copper-plate map by the heliogravure process. His method consists in making a reverse negative of the drawing, from which negative a transfer is printed on pigmented gelatine. The gelatine is coated with graphite, immersed in an electrotype bath, and a thick plate deposited, about two weeks being required. The plate simply needs cleaning and retouching to make it ready for printing. The work of engraving a map by hand is necessarily slow and tedious. By the new process the work is considerably facilitated.

John H. Felmlee, an inventor of Pittsburg, Pa., has just perfected a wrapping machine which will handle with great rapidity a piece of any size from a caramel to a cake of soap, and wrap it up in a faultless manner. A company has been formed, and will soon be engaged in the manufacture of the machines to meet the requirements of various industries. The machine performs about forty different operations, including the cutting of the paper from a roll. A machine has been constructed which is worked by hand, and the inventor says the capacity of this is 175 pieces per hour, but this would be greatly increased by driving it with an engine.

A pressure-recording oarlock has been invented by Prof. W. C. Marshall, instructor at the Sheffield Scientific School at Yale. The device will be of great value in the selection and training of oarsmen, and it will be put to the test next fall in the selection of candidates. The apparatus weighs only about three pounds, and is placed on the end of the outrigger in the place of the usual oarlock. By its use the pressure exerted at every stroke is measured and registered, so that accurate comparisons can be made of the actual work done by a man at start and finish. This record can be kept for a distance of four miles. Application has been made for a patent.

Former State Senator James Arkell, of New York, who died during the early part of August, was a holder of a number of valuable patents covering the manufacture of paper for various special purposes. Some time ago he devised a method of making a paper which had the quality of stretching slightly without breaking, and this came into great demand for the lining of sugar barrels and other similar purposes. This paper was yielding only in one direction, and he more recently improved on the process and succeeded in making the paper more elastic than ever. He was an Englishman by birth, and came to this country when quite a boy and began life on a farm. He soon after drifted into the newspaper business, and managed a local paper. From this he went into paper making. During the civil war he made a great deal of money out of the manufacture of paper sacks by a process which he devised.

Legal Notes.

SALE OF PARTS OF A PATENTED COMBINATION.—The recent suit of the National Phonograph Company vs. Fletcher (117 Fed. Rep. 149) brought out a curious state of facts. The complainant owns three patents covering reproducers used in the Edison phonograph. The defendant by circulars requested owners to send their Edison reproducers and promised to return them so improved that they would better perform their functions. Many reproducers were received, nearly all of which came from one or two dealers in phonographs or phonograph supplies. A few were received from individual sources. Hence, the defendant did not buy or sell reproducers in the usual way, but for the purpose of their alleged better operation added labor and material to those owned by others. For this he was paid. There was no direct evidence that the reproducers refashioned thereby received increased strength. Several of the reproducers were sold primarily by the complainant; each purchaser paid the complainant the proper tribute. There was no direct evidence that the defendant's traffic had diminished the plaintiff's sales in number or amount. In what way had the defendant been wrong? He added his improvements wherever owners of reproducers would permit him so to do; and save in a few instances returned them to dealers. The defendant substituted new parts for some of those that he did not patent, changed others, and used some of the old parts in new relations. After these changes he returned the machine to the dealer to be sold as that of the patentee.

Since there was no occasion for repairs, the law relating to that subject had no specific application. The question was, therefore, whether a person may receive reproducers needing no repairs, place his improvements thereon and return with a substitution, or change of relation of every part; or with a specifically patented part of the combination reproduced and readjusted. As to the renewal of the patented parts, the Court held that there was no doubt of infringement. The final inquiry related to the infringement of the Edison patent which covered the combination of parts which had been changed. The Court held that the modification, substitution, and change of relation of parts passed the limit of allowable repairs. Reproduction, not restoration, was intended; for there was no occasion for restoration. If the defendants had the right to repair, it could not be maintained; for no one acquainted with the appearance of the Edison reproducer could easily discover it in the Fletcher reproducer.

The defendant's broad claim was that he could take the reproducers with all their parts and refashion or reassociate the parts, so that his creation and that of Edison's were blended and placed with dealers for sale as Edison's genuine device. In other words, the defendant claimed the right to gather up all of the defendant's output, recast, subtract what he wished, add his own parts, good or bad, and float again as the patented product simply because he used some of the original parts. The Court remarked: "If patented machines may be refashioned to suit every skilled or unskilled improver and marked as originals with Fletcher's improvement, the inventor is at the disadvantage of having numberless coadjutors, whose association he does not invite and whose improvements may mar the action, merit or fame of the original device. The improver obtains the benefit of a patent without return, it may be, of equal benefit, and the inventor's goods are on the market in any or every form, good and bad. It is true that an owner may do what he will with a patentable machine which is his property. But the experiment is at his own peril. If he attempts to resell it as the inventor's, he may be destroying the merit of the original invention, and may be substituting something of his own conception. What a man may do for his own use in accordance with a patent is not what he may do for the purpose of selling as another's a patented article." It was therefore, considered that the defendant's traffic involved the placing of Edison's reproducers on the market hampered with alleged improvements which might injure complainant's business, and which concealed the identity of the original reproducers. A decision was given for the complainant.

ANTICIPATION AND CONSTRUCTION OF CLAIMS.—Suit was brought by the De Lamar Company against the De Lamar Mining Company for infringement of letters patent granted to Waldstein for an invention in an improvement in a process for the recovery of precious metals from their solutions. The Circuit Court held the patent void. The plaintiff appealed, and the Circuit Court of Appeals (117 Fed. Rep. 240) affirmed the decree. Waldstein's claims covered the use of zinc dust in a state of agitation; secondly, a definite quantity of zinc dust in a state of agitation sufficient only in quantity thoroughly to precipitate the contained metals; and thirdly, a process of extracting and recovering metals from their ores consisting of certain specified steps. The first and fourth of these steps were held by both courts to be beyond question old. The second and third of these steps consisted in supplying to the solution charged with the precious metals the exact quantity of zinc dust ascertained (without telling how) to be sufficient to precipitate the metals, and agitating the solution and zinc dust until the metals were precipitated and the dust absorbed. The Circuit Court of Appeals found that the additional features in requiring the use of a definite quantity, or the exact quantity of zinc dust sufficient to precipitate the contained metals, did not render the process patentable; since the proper proportion was not given, nor the means for ascertaining it. Conceding that such fact did not render the claims fatally defective, the Court held that the patentee not being the inventor of the use of zinc dust by means of agitation as a precipitating reagent, the public was free to use such quantity as might be required best to produce the desired result.

FALSE NOTICE OF COPYRIGHT.—A section of the United States copyright law provides that "every person who shall insert or impress" a false notice of copyright "in or upon any book . . . for which he has not obtained a copyright in the United States" shall be liable to a penalty of $100, recoverable one-half for the person who shall sue for such penalty and one-half for the use of the United States. In 1896 Raphael Tuck & Sons Company imported from a foreign country books bearing a false copyright notice. The notice was impressed upon them in Germany by the publisher, by authority of the importers, and the importers subsequently sold the books in this country. In an action against the importers for the penalty the United States Circuit Court for the Second Circuit held that they are not liable, as the statute could not have extra-territorial effect. In 1897 the copyright law was amended so as to subject to penalty, in addition, every person "who shall knowingly issue or sell any article, bearing such false notice of copyright." As the books in question were imported prior to the passage of the amendment, the court held that they were not liable under it, though it was shown in the action that part of them were sold in the United States after its passage.—McLoughlin vs. Raphael Tuck & Sons Company, 115 Fed. Rep. 85.

THE EFFECT OF PRIOR PATENT ADJUDICATION INFRINGEMENT SUITS.—In an action recently brought by the Westinghouse Electric and Manufacturing Company against the Royal Weaving Company, the United States Circuit Court for the District of Rhode Island stated that the decision of a Circuit Court sustaining the validity of a patent and affirmed by the Circuit Court of Appeals should be accepted as controlling by a Circuit Court of another circuit on an application for a preliminary injunction against infringement in the absence of contrary decisions, unless it is shown not only that new matter and new evidence are presented, but also that the new matter is such as might require a different decision as to the validity of the patent.

If the owner of a patent has established its validity in an ably-contested litigation there seems no reason why he should not be entitled to protection of rights thus established, and why he should be refused a preliminary injunction against another infringer. The action which called forth these expressions of opinion had as its basis the Tesla patent for electromagnetic motors and for a method of the electrical transmission of power.

THE EFFECT OF PRIOR PUBLIC USE ON VALIDITY.—The Thomson-Houston Electric Company brought an action against the Lorain Steel Company (110 Fed. Rep. 654) for infringement of the Van Depoele patent for an improvement in commutator brushes or contacts. The essential feature of this invention is the use of carbon as the material for the brushes. In the Circuit Court the conclusion was reached that the patentee made an open and public use, not experimental, of his carbon brushes on a motor in what was known as the "telpher" system for more than two years prior to his application for the patent. On this ground the Court dismissed the bill. The case was appealed and the decree affirmed. (117 Fed. Rep., 249.)

DEDICATION TO THE PUBLIC.—Though clear evidence of an intention to dedicate an improvement to the public is indispensable to establish an abandonment under the patent law, still it is held that a patentee dedicates to the public every combination and improvement apparent on the face of his specifications which he does not point out and distinctly claim as his discovery or invention, and the insertion, in a reissued patent, of claims for inventions which were described, but which the patentee never claimed or intended to claim, or to protect by the original patent, is unauthorized by the acts of Congress, and such claims are void.—Ide vs. Trorlicht Duncker & Revard Carpet Company et al., 115 Fed. Rep. 137.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

SOWING APPARATUS.—G. K. SPITZENBERG, Forsthaus Leuenbergerwiesen, near Eberswalde, Germany. The present invention relates to a sowing apparatus for use in forestry, agriculture, and horticulture, which is carried in the manner of a knapsack. This sowing apparatus can be used with all kinds of seed and under any conditions of ground and soil, for instance, in mountainous districts, where vehicular apparatus cannot be used.

COLTER-BEARING.—T. R. WALLIS, Dyersburg, Tenn. The invention provides an improved bearing on which the colter may be mounted to turn freely with relatively little friction. The colter disk is held by two hub sections mounted on a thimble through which a bolt passes. The bolt is fastened against the outer faces of the arms of the plow and the thimble sets between the arms, with one end squared and fitting snugly into an opening in the adjacent arm. The hub of the colter turns loosely on the thimble.

ADJUSTABLE CULTIVATOR-TOOTH.—F. G. HOAG, Battlecreek, Mich. An object of the present invention is the provision of means for securely fastening the tooth of a cultivator to the machine frame. The construction is such as to allow the holding device and the tooth to be shifted back and forth on the frame, while the tooth can be adjusted vertically without disturbing the position of the holder and thus the position of the tooth can be regulated at will.

Electrical Apparatus.

ELECTRIC INTERRUPTER.—L. G. NILSON, New York, N. Y. It is well known that in ordinary induction coils using platinum-tipped contacts in the vibrator, even with proper condensers the contact points will burn or corrode more or less. This burning or arcing not only destroys the points rapidly but gives poor results in the secondary of the coil. It is also well known if an electric connection is broken producing a spark or an arc in the magnetic field, the magnetism will have a tendency to diminish or blow out the spark. In order to produce the best results and at the same time improve the action and prolong the life of the moving parts, Mr. Nilson has provided an interrupter in which the magnetism of the interrupter itself is utilized for blowing out the destructive spark at the primary contact points.

CONTROLLER FOR ELECTRIC MOTORS.—L. G. NILSON, New York, N. Y. Improvements in controllers for electric motors particularly of the class used for electric vehicles are provided in this invention, the objects of which are to improve and simplify the mechanical construction and general arrangement, so as to cheapen the first cost, reduce wear to a minimum, have all parts easy of access, and render the operation of the whole convenient and reliable.

AMPERE-HOUR METER.—W. A. SHERLOCK, San Francisco, Cal. This ampere-hour meter will measure either direct or alternating currents of any phase or frequency. It is also intended for use as a student's watt or volt meter and for numerous electro-chemical demonstrations in school laboratories. It comprises a receptacle containing an electrolyte of a kind in which the electrical conductivity is increased by heat. A current is passed through this electrolyte for the purpose of producing gases the volume of which is measured. The resistance in the circuit is also measured and means are provided for raising the electrolyte, gases, and resistance, to a predetermined temperature.

TELEPHONE-SWITCH.—J. A. WARRICK, Sheldon, Ill. This telephone switch is provided more particularly for use on party lines. The object of the switch is to enable any two or more instruments upon such a line to be brought into use without molesting other instruments upon the same line. By this system any reasonable number of telephones may be placed in the same circuit and any subscriber may select and talk to any other subscriber without danger of eavesdroppers being able to hear what is said.

Engineering Improvements.

EXHAUST-MUFFLER.—H. N. WHITTELSEY, Camden, N. J. The present invention provides improvements in mufflers for the exhaust of combustion of steam engines used in propelling launches and other vessels. The muffler is in the form of a submerged condenser so constructed as to cool and effectually condense the exhaust gases and vapors and emit the small volume uncondensed in a continuous stream.

STEAM OR VAPOR TURBINE.—H. T. LEES, Brooklyn, N. Y. Mr. Lees provides in the present invention an improved turbine adapted to be driven by steam or other vapor. The construction is simple and durable and very effective in operation. It is arranged to utilize the expansion of the motive agent to the fullest advantage to obtain an exceedingly high rate of speed at a comparatively low initial or boiler pressure.

Hardware.

WRENCH.—J. F. BARRETT, 20 South Church Street, Carbondale, Pa. A novel form of wrench is provided in this invention which may be used in connection with a woodworker's hand brace. The improved tool has a shank for engagement with the socket of the brace and at its gripping end is provided with fingers which are adapted to be closed on a nut or a screw-bolt by turning an adjusting nut on the body of the tool.

LOCK.—L. DALTON and D. CROSS, Santo, Texas. An improvement in combination locks for doors, safes and the like has been provided by these inventors. The lock is equipped with readily operated means for holding the combination disks inactive and in position to permit a locking bolt to be freely operated by a key when so desired. This means will also permit the combination to be set so that the bolt cannot be moved by a key until the disks of the combination have been brought to proper position. The lock can thus be used either as a combination lock or as an ordinary lock.

Mechanical Devices.

DOUGH-KNEADING MACHINE.—R. I. A. MASON, Hampton, Va. This dough-kneading machine comprises a frame having a central standard on which a pan is mounted with its bottom inclining upwardly toward the center. Two tapering rollers are provided journaled respectively to bear against the upper and lower surfaces of the pan. A shifting cutter is arranged in the rear of the upper roller and is adapted to divide the layer of dough into inner and outer sections and to deliver the inner section onto the outer one.

ALINER FOR TYPE-BARS OF TYPE-WRITERS.—J. ALEXANDER, New York, N. Y. Mr. Alexander's invention relates to improvements in aliners for typewriters and the object is to provide a simple, adjustable device to cause the type to strike on the paper in proper place or in proper alinement.

WELL-DRILLING MACHINE.—R. B. MOORE, Yarrelton, Texas. An improved well-drilling machine is provided by the present invention. The machine is adapted to be driven by horse power and is arranged to permit of actuating the drilling tools for drilling purposes, and to allow of conveniently and quickly raising the tools from the well whenever it is desired to sharpen or repair them.

WHEELED-SCOOP.—J. J. GYLLDENBORG, Grenada, Miss. This invention which relates to wheeled-scoops has for an object to provide certain improvements in the general construction of the implements as well as in the operating means and devices for supporting the scoop.

Railway Improvements.

BRIDLE-ROD FOR RAILROAD-RAILS.—W. E. COPELAND, El Paso, Texas, and M. M. MASSEY, Alamogordo, New Mexico. This invention provides an improved bridle-rod especially designed for use in connection with track laying machines when the tracks are laid down in front by the track layer as the train moves ahead and the spikers follow, the train hands removing the rods, which are then carried ahead and again used.

COAL-TIPPLE.—F. W. WILLIS, Pratt, W. Va. The purpose of this invention is to provide an economical coal-tipple automatic in its action and so constructed that the loaded car will approach the dumping platform at an inclination downward to the same and will leave the dumping platform at a downward inclination therefrom, the rails for the loading car being at a greater elevation than the rails for the empty cars.

RAILROAD TIE OR BRIDLE.—J. G. CARLSON, Eggleston, Minn. The metallic tie or bridle herein provided consists of base or end pieces provided with transverse grooves and projections on their upper faces and an end lug or cheek piece having a beveled face adapted to engage the rail, a stretcher or cross bar provided with transverse grooves and projections adapted to interlock with the grooves and projections of the base or end pieces, and a bolt fastening for securing the stretcher and the end pieces together and to the rail.

Technology.

PROCESS FOR REFINING ASPHALTIC MINERAL OILS.—J. C. MIMS, New Orleans, La. This process of removing asphaltum from mineral oils containing a high percentage of asphaltum consists in adding to the oil a mixture of about five parts by weight of potassium bichromate to 95 parts of sulphuric acid in quantity equal to 1 to 10 per cent of the oil, allowing the asphaltum and associated impurities to settle and then washing the oil with an aqueous solution containing about 5 per cent of sodium hydroxide and 5 per cent of sodium carbonate and then separating the purified oil from the sedimentary matter.

PROCESS OF SEPARATING PROTEIDS FROM NON-NITROGENOUS BODIES.—J. CARSTAIRS, Bradford, England. The process consists in mingling the confined nitrogenous proteid and the fat or oil with a solvent comprising a saturated solution in methyl-alcohol, of nine parts of phenyl-alcohol and one part of benzyl-alcohol, and heating the resulting mixture to the point of liquefaction.

SENSITIZED MATERIAL AND PROCESS OF MAKING THE SAME.—A. H. MIES, Jr., Büdesheim, and A. COBENZL, Bingen, Germany. In order to produce photographs on fabrics the latter are previously treated with an extract of Iceland moss and, when dry, sensitized in the usual manner. This process, however, has the disadvantage that after a time the photographs show spots. To overcome this difficulty the present process has been invented which consists in impregnating the fabric with a solution of soluble starch, subsequently drying the impregnated fabric to render the starch insoluble and finally giving a sensitized surface to the dry starch-impregnated base.

Vehicles and Their Accessories.

FRONT FOR VEHICLE TOPS.—J. B. MCMULLEN, Howard County, Md. Mr. McMullen's invention provides an improvement in fronts for vehicle-tops. A novel construction is employed which can be conveniently applied to the buggy, will serve to protect the occupants of the buggy when turned down to position for use, and can be conveniently folded up into the top of the vehicle when not in use.

AXLE.—L. G. NILSON, New York, N. Y. It is a common practice to make the steering axles for automobiles of solid forgings with forks or sockets at the ends for receiving the steering knuckles. This renders a heavy and expensive axle for the strength required. It is an object of the present invention to overcome these difficulties by providing an axle that shall be comparatively light, with sufficient strength, and so constructed that the knuckles and springs may be easily fastened in place.

NECK-YOKE.—S. J. MCDONALD, Gallatin, Mo. Novel details of construction are provided in this invention which adapt this neck yoke for very efficient service enabling the proper connection of the improved device with neck yoke bars of slightly different diameters, rendering the connection between the vehicle and the neck yoke, yielding in two directions, and adapting the contact of the neck yoke ring to avoid injurious abrasion of the finished surface of a vehicle pole.

Miscellaneous.

STOVE OR RANGE.—E. BEATTY, New York, N. Y. Mr. Beatty's invention provides certain useful improvements in stoves and ranges whereby complete incineration of garbage and the like is permitted, without disturbing the burning fuel in the firebox and without causing obnoxious gases to pass into the room in which the heating apparatus is located.

FRUIT-ASSORTING TABLE.—C. D. NELSON, San Dimas, Cal. Improvements in fruit-assorting tables are provided in this invention, which are more especially designed as a means for grading oranges and lemons according to different qualities. It is now the common practice to assort oranges and lemons into three grades known as "fancy," "choice," and "standard." The present invention provides a simple machine on which this grading may be easily effected by operators stationed on both sides of the apparatus.

COMB.—J. A. CLINTON, Brooklyn, N. Y. This comb belongs to the class used by ladies for holding the hair and for ornamenting the same. The comb is provided with a series of movable teeth which co-operate with a series of fixed teeth to grip the hair and thus hold the hair and comb in place.

WELL-TUBE LIFTER.—J. NEUMEIER, La Crosse, Wis. Mr. Neumeier's improvement consists in so arranging the parts of the ordinary well-tube lifter as to permit the devices to clutch the side of a well-tube at any point along its length, or to permit them to be reversed to lift the well tube by loosely embracing the same at a point below the enlargement of the coupling section.

SOUNDING-BOARD.—SARAH W. CLARK, New York, N. Y. Improvements in sounding boards are provided in this invention which are particularly adapted to the use of violinists and other soloists playing with the piano or like accompaniments. The object is to provide a portable sounding board that may be placed where desired to give the best effect in spreading or giving force and distance to musical sounds.

ANIMAL-TRAP.—H. SARGENT, Corvallis, Ore. One of the objects of this invention is to equip a trap with a simple and efficient style of firearm adapted for service in connection with fixed ammunition, which may be automatically discharged or exploded so as to kill burrowing animals, such as gophers, moles, etc., as well as other objectionable animals. The trap is equipped with a novel tripping mechanism which may be operated by the pushing movement of burrowing animals or by the pull of other kinds of animals in the effort to dislodge bait from an element of the tripping mechanism.

HORN-FENDER.—C. W. ALLEN, Merriman, Neb. Mr. Allen provides, by the present invention, a simple means for preventing cattle from goring each other, thus overcoming the necessity for dehorning the cattle. The invention comprises an efficient guard which may be easily and snugly fitted to different kinds of horns in a manner to avoid rattling thereon.

STRAINER FOR WELL-TUBING.—J. MCK. WARE, Shufeston, La. This invention comprises certain improvements in well-tubing of the class commonly known as "drive-wells," that is, tubular-wells formed by sinking into the earth a tube shod at its lower end with a piercing point. The present invention is designed to obviate objections to strainers as now used, and to that end Mr. Ware has devised a strainer that is not liable to be disarranged while the tube is being sunk.

BOTTLE.—V. D. WHITE, Cottagegrove, Ore. An improved bottle closure has been invented by Mr. White, being in the nature of a non-refillable bottle or one in which the bottle will indicate whether it had been opened after leaving the original bottler, so that its contents cannot be counterfeited.

HORSE APRON.—J. SULLIVAN, New York, N. Y. This apron is adapted to catch and retain excrement and thereby keep a stall clean. The device is so constructed that it may be expeditiously and conveniently attached to or detached from a stall and when in position is located horizontally at a point immediately at the rear of the animal below the rump.

INVALID BED AND COMMODE.—W. C. FEELY, New York, N. Y. The invention relates to invalid beds and commodes, and its purpose is to provide a simple and easily-operated construction of telescopic bed including a support for a commode. The commode is removably mounted and is vertically and laterally adjustable.

DESIGN FOR FABRIC.—C. E. HOWE, New York, N. Y. The design consists of the representation of a series of railway rails, and arranged at various points between pairs of rails are representations of locomotive engines, also at various points are representations of oil cans, wrenches and hammers.

BEDSTEAD.—W. A. REDDICK, Niles, Mich. This invention relates to an improvement in bedsteads preferably made of wire in which the head and foot boards fold inwardly and downwardly inclosing the bedclothing. Heretofore in bedsteads of this character when packing the same for transportation it was necessary to remove the bedding before folding the head and footboards which were pivoted at the extreme ends of the frame and the legs of which projected out a considerable distance beyond the ends of the frame, thus requiring a larger packing box. These difficulties are overcome by the present invention.

ROD FOR WIRE FENCING.—A. T. DE BARY, Buenos Aires, Argentina. Certain styles of the ordinary rod or stay require attachment to the line wires of a fence by the employment of fastening wires. But this method of attaching stays is not satisfactory because of increased cost and time required to fasten the parts. The object of this invention, therefore, is the provision of a simple and inexpensive construction adapted for attachment in a manner to hold itself positively against displacement in any direction without resorting to the use of separate fasteners.

MAIL-BOX INDICATOR.—L. T. CAROTHERS, Carey, Ohio. The mail-box indicator invented by Mr. Chambers is especially intended for use on letter boxes to indicate the times of collections of the mail therefrom by the carrier or other collector. The invention also provides means whereby the times indicated on the box for the collection of the mail can be readily changed to suit new schedules.

GAS PRODUCER.—J. A. MITCHELL, Brooklyn, N. Y. Mr. Mitchell's invention relates to an apparatus for producing gas in which some important improvements have been made. The fuel is fed into the apparatus from above. The grate which has a spiral formation may be revolved to drag the ashes down into the ash-pit. A heat blast passes up through the center, acting continually on the fire to maintain combustion.

MATCH LIGHTER.—J. PROOPS and S. HILSUM, New York, N. Y. The device is arranged to enable a person to readily scratch a match for igniting the same without danger of setting fire to surrounding objects by an ignited, broken-off match-head. The match lighter is of a simple and durable construction and may be very neatly made.

METALLIC VESSEL.—J. E. CASE, Clifton Springs, and W. T. CONWAY, Canandaigua, N. Y. It is well known that pails, pans and other vessels manufactured of tin plate or sheet metal are liable to have their bottoms deteriorate through rust when placed on the ground, in a sink, or otherwise subjected to the action of moisture. This objection is overcome in the present invention by the employment of a non-corrosive material in the manufacture of the bottom.

CUSHION HEEL-PLATE.—H. F. DERNELL, Athens, N. Y. The inventor has in view the provision of a simple and cheap construction in which the metallic and cushion elements used on the heels of boots and shoes are so intimately combined and related that the cushion will remain attached to the metallic part until it is worn entirely away, and the plate and cushion will wear uniformly for a longer time than an ordinary heel or plate.

CLOTHES-DRIER.—F. S. MACDOUGALL, Seattle, Wash. The present invention relates to improvements in clothes-driers and has for its object the provision of improved means adapted to allow the group of arms when adjusted to their horizontal positions to be swung in either direction from a central position, thus enabling the arms to be compactly arranged with relation to a wall or any other place where the device may be hung.

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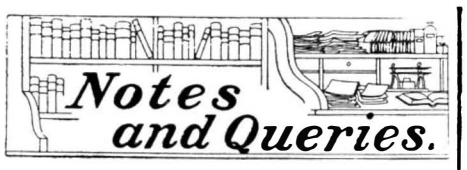

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the omce. Price 10 cents each.
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Minerals sent for examination should be distinctly marked or labeled.

(8769) L. W. B. says: Will you kindly tell me what are the contents of a piece of timber, board measure, in feet, 6x6 at one end and 18x18 at the other end, 12 feet long, and the mode of calculating same? One party claims 156 feet, another 144, and a third one 180. A. The tapering piece of timber whose contents you wish to know in board measure is a frustum of a pyramid. The easiest way to find its board measure will be to calculate its cubic contents and multiply these by 12 to change to board measure. Its volume is found by the following rule: Find the area of the two ends and the mean proportional between them. Add these together, and multiply the sum by one-third of the length of the frustum.

Large end..... 1.5 x1.5 = 2.25 sq. ft.
Small end..... .5 x .5 = .25 sq. ft.
Mean proportional.. $\sqrt{2.25 \times .25}$ = .75 sq. ft.
Sum ..... 3.25 sq. ft.

$$\text{Volume, } 3.25 \times \frac{12}{3} = 13 \text{ cubic feet.}$$

Board measure, 13 × 12 = 156 feet.

(8770) E. B. H. says: Can you suggest a remedy for the removal of rats from the yard? Such a remedy as will not kill domestic animals and such a remedy as will not destroy plants. A. All of the rat poisons, of which white arsenic is the most efficient and most frequently used, are equally poisonous to other animals. Putting a lot of broken glass into their burrows is said to be effective in driving away the rats, as they cut themselves badly in gnawing and burrowing. A ferret turned loose in the yard would quickly kill or drive away the pests.

(8771) J. J. O'B. writes: With the view of settling some technical mechanical problems, I respectfully ask that the following question be answered through the columns of the SCIENTIFIC AMERICAN. Is the elasticity of steel or metal spiral springs (of first-class construction) accurate enough to be employed in the regulating of a time mechanism, either as main parts thereof or as auxiliary parts to pneumatic retarding pistons, such as are employed in the modern photographic shutters? A. The resilience of a well-tempered steel spring is the greatest and most perfect in all parts of its range of any known metal. Its endurance when kept free from rust is also greater than other metals. Its time movement is also perfect if not retarded by other and frictional elements, as the piston and other mechanism of a photographic shutter.

(8772) J. T. M. asks: Do you know of any machine by which shavings and sawdust could be pressed and made available for fuel under boilers? A. Sawdust and shavings are now largely utilized in firing boiler furnaces by blowing the loose material into the furnace. The briquetting of sawdust and shavings has been tried and found inconvenient and expensive. In many woodworking factories the entire waste is burned under the boilers. It is drawn from the machines by a suction fan and deposited in bins at a higher level than the boiler furnaces, to which it is passed by a chute in measured quantities. In other factories it is moistened by a water jet as it passes into a vertical chimney through which the air from the fans passes off, and all dust saved and the nuisance of wood dust in the neighborhood is avoided. The firemen shovel the moist sawdust from the bottom of the chute to the furnace.

(8773) T. C. asks how to make a simple electric water heater suitable for heating a small glue pot, by using the current that supplies the ordinary incandescent light; some sort of arrangement that could be set in the water if possible. A. For an electric heater to be used in place of an ordinary incandescent lamp you should not take more than one ampere of current. German silver wire may be used, No. 24 being a good size. If the current is of 110 volts pressure, 330 feet will be required. If it is 52 volts, about 150 feet will answer. This must be wound and insulated by asbestos, else the fire insurance is void. It should be inclosed in a metallic tube, in order to place it in the water to be heated. Twice the length of iron wire may be used.

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December 9, 1902,

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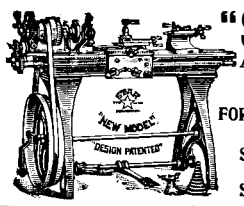

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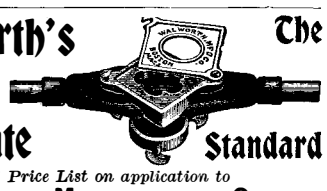

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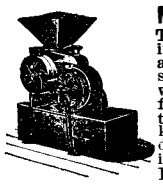

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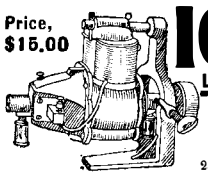

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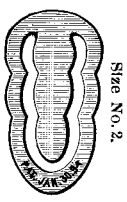

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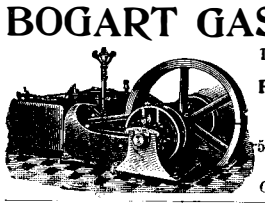

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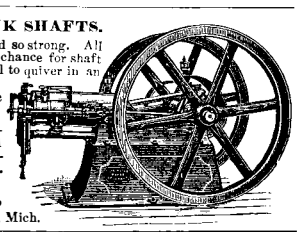

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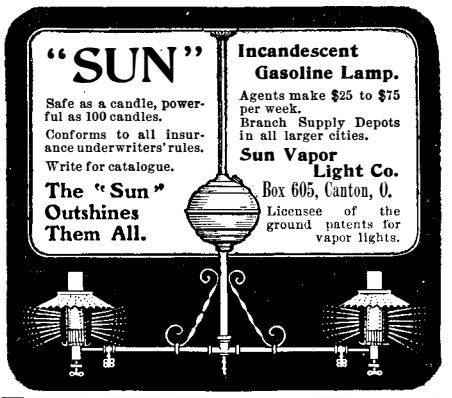

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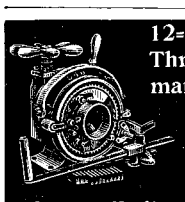

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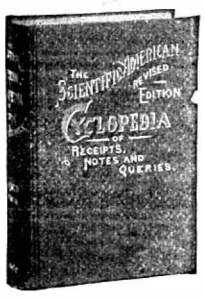

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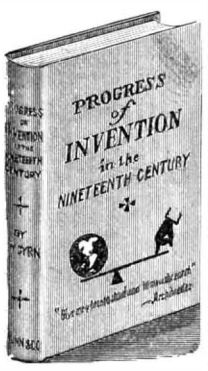

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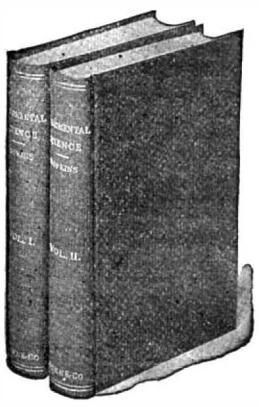

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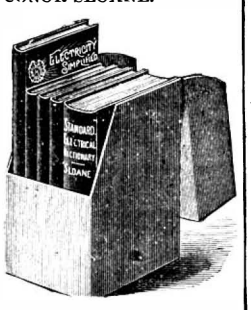

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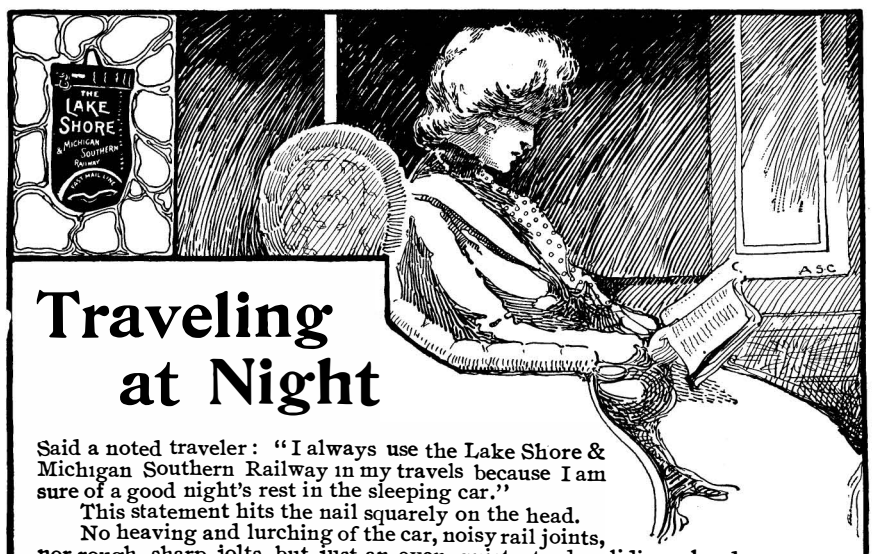

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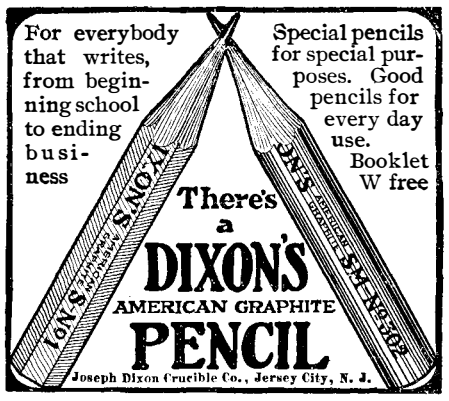
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THE AUTOMOBILE. By Paul V. Hasluck, Philadelphia: David McKay, 1902. Pp. 608, 536 illustrations. Price $4.50.

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ELECTRICAL DICTIONARY. English, German and French. By Paul Blaschke. Leipzig: S. Hirzel. 1902. 8vo. Pp. 226. Price $1.50.

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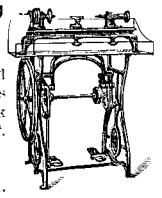

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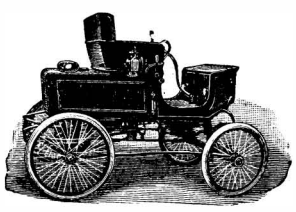

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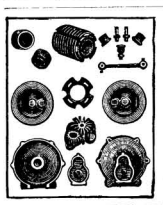

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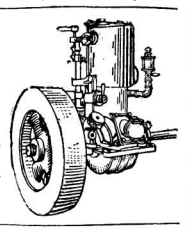

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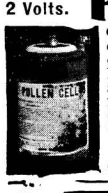

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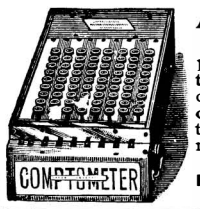

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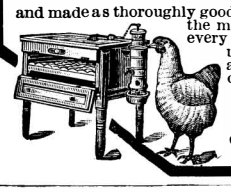

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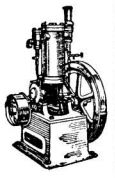

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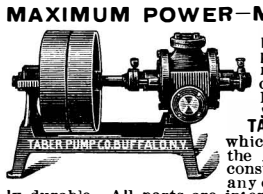

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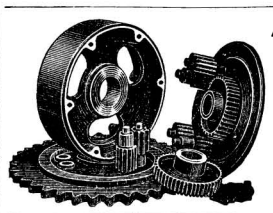

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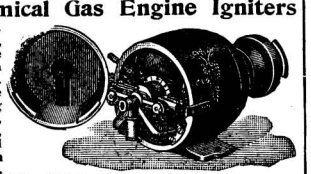

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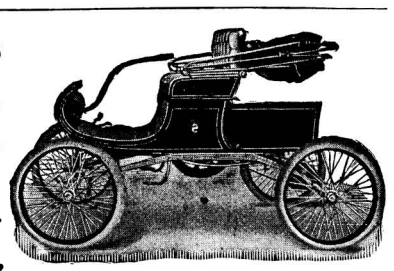

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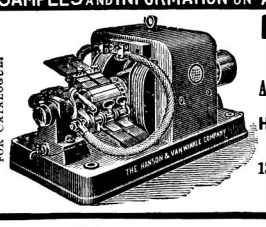

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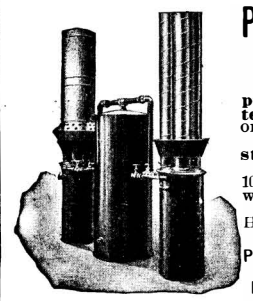

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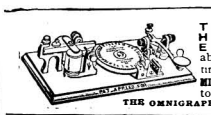

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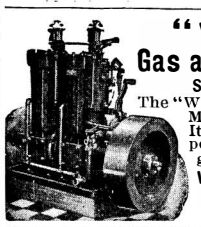

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